

LET'S RIDE JC

Bikeway Design Guide

September 2019

HEY, THANKS!

To the Mayor, City Council, Business Administrator,
Division of City Planning, Division of Engineering
Traffic & Transportation, and all of the TAC mem-
bers for for helping make this design guide a reality.

To the Let's Ride JC Bikeway Design project team:
Arterial

Sincerely,

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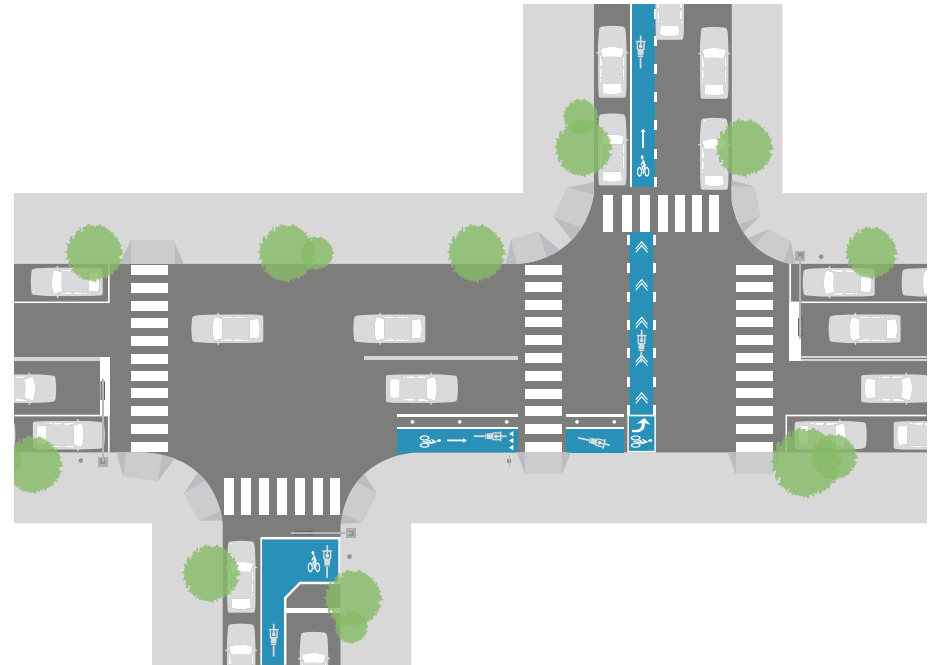
ABOUT THIS GUIDE

The Let's Ride JC Bikeway Design Guide provides an illustrative, technical resource for government agencies, consultants, citizens, and community groups in the development and implementation of the bicycle network outlined in the Let's Ride JC Bicycle Master Plan.

Compiled within are typical bikeway and street design treatments one might find in standard traffic engineering manuals as well as best practice design elements that have proven to increase safety and access for all street users. The manual also highlights typologies and suggested treatments for specific conditions in Jersey City, including narrow, one-way neighborhood streets, offset intersections, bus stops along constrained and congested streets, and highway/rail crossings and underpasses.

The content of this design guide is organized into chapters on bikeways and pavement markings, intersection safety treatments, bicycle parking, and signage. Following this, there is a chapter on “shared active mobility” which specifically discusses bicycle sharing systems (i.e. Citibike), the emerging trend of dockless bikes and scooters, and broader issues of network inclusivity that have implications for current and future facility designs. Finally, there is a short chapter outlining the “quick-build” project delivery methodology for implementing the Jersey City cycling network.

The guidance in this manual is culled from local, national, and international sources which specifically include the NJDOT Complete Street Design Guide, NACTO Urban Bikeway Design Guide, FHWA's Separated Bike Lane Planning and Design Guide and Manual on Uniform Traffic Control Devices. Further inspiration is pulled from



projects Street Plans has implemented in other cities as well as examples of innovation from around the globe. A comprehensive list of references and resources is included in the guide's appendix. The elements cataloged herein are each presented with imagery and guidance on their applicability, usage, and design criteria such as materials, color, and dimensions, and categorized as “required”, “recommended”, or “optional”, as appropriate. However, it is important to note that the elements shown are only examples and that in all situations, street designs should ultimately be based on engineering and urban design judgment that responds to the context and conditions of specific streets where treatments are to be installed.



DAURIN'S
Hair Salon & Spa

DAURIN'S
Hair Salon & Spa

Glenwood Ave

BIKEWAYS

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The strongest determining factor of whether or not people bicycle is, regardless of the layout, the terrain, or the temperature, how safe and comfortable they feel while cycling on City streets.

In modern US cities with significant automobile traffic, this feeling of safety (or lack thereof) is heavily influenced by the presence (or lack) of bikeways. Bikeways are areas of the public realm - streets and parks - which are specifically designated for use by bicycles, as well as other active modes of transportation, generally through signage, signals, pavement markings, and paths. Bikeway designs can vary considerably from city to city and street to street, but in all cases, their function is to communicate to people bicycling where they are encouraged to ride, and to alert pedestrians, vehicles, and other street users to their presence. Having designated street space also allows cyclists to proceed at a pace at which they are comfortable - faster than walking but slower than vehicles.

The first section of this chapter walks through the variety of markings which are used to designate bikeways, similar to a list of ingredients which can be combined to form different recipes. Following that we walk through the four major categories of bikeways which are: shared lanes, conventional bike lanes, and separated bikeways. Shared lanes combine vehicle and bicycle traffic in one lane of slow-moving traffic, which is not advisable unless there is no other practical solution or if paired with more substantial traffic calming interventions (see Neighborhood Greenways on page 58). Conventional lanes are painted on the street and typically run alongside vehicle traffic going in the same direction, although in some cases may run contraflow. Separated bikeways are ideal for cycling in that they feature design treatments which give cyclists generous spacing and often physical protection from vehicle traffic.



Matching facility selection with street design context requires thoughtful analysis and is ultimately subject to the judgement of transportation planners and traffic engineers. Bike lanes may vary in type, length, width, color, and supportive operational elements such as signs, markings, and signals. The Let's Ride JC Bicycle Master Plan (which this document accompanies) lays out a proposed bicycle network with general recommendations for the type of lanes to be applied to specific streets across the city. However, before any new facilities are installed, there will need to be a careful study of the street conditions to make a final determination about what bikeway type and design details are most appropriate, which should be informed by this Guide.

A 2014 study by Portland State University on new protected bike lanes in five major cities across the United States revealed a:

21% to 171% increase in ridership compared to pre-protected bike lane numbers,



with 10% of new riders drawn from other modes of transportation.



Via Monsere, et al. 2014.

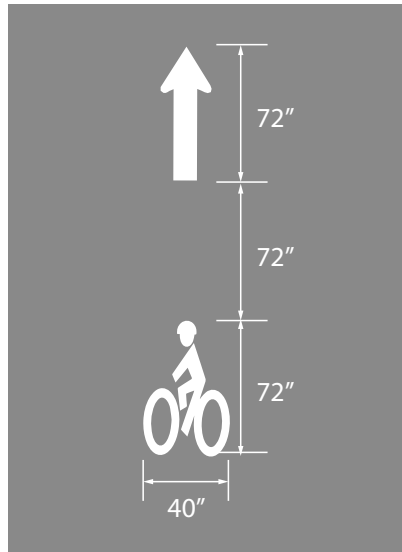
1. BIKEWAY MARKINGS



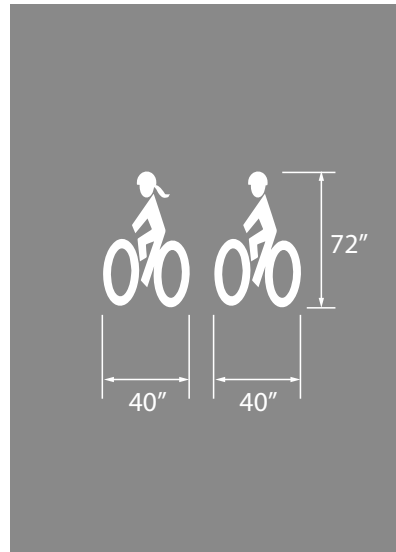
A range of bikeway markings will help make Jersey City's bicycle network more legible and intuitive for cyclists, as well as all other roadway users. These markings, along with the design guidance provided, make up the essential ingredients which can be combined to create functional, enjoyable, and even whimsical (see left) bicycling facilities throughout the city.

BIKE LANE MARKINGS

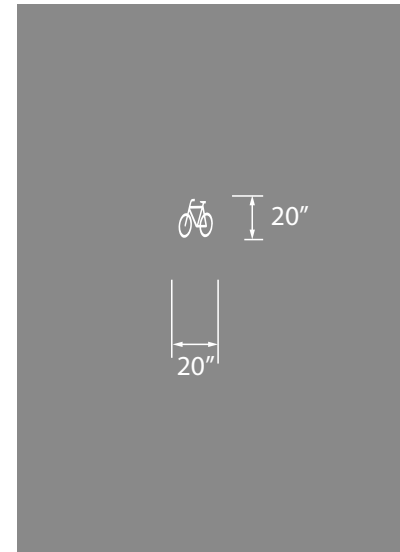
Bikeway markings are specifically for establishing areas of the street right-of-way meant for the exclusive use of people cycling, and to support safe interactions with other street users, such as people walking and driving. These markings generally use the vernacular of national design standards so that they are familiar to motorists.



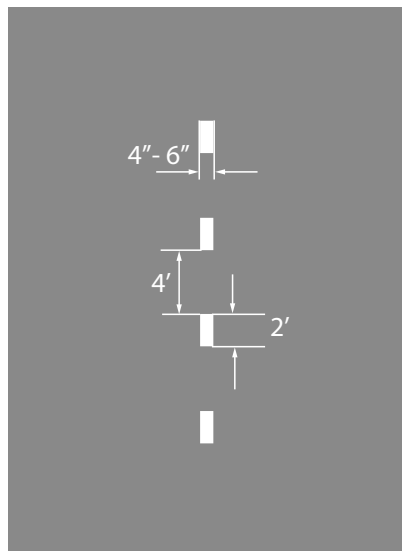
Bike Lane Symbol



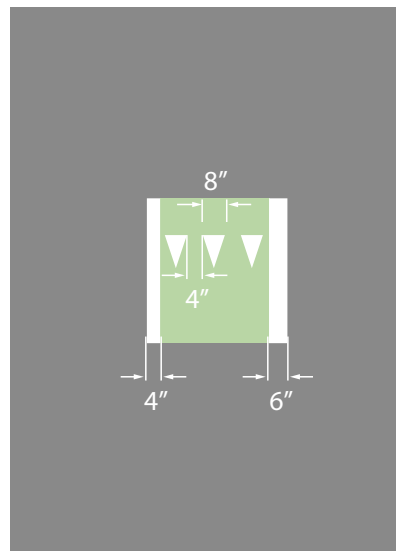
Bike Symbol
(ponytail option encouraged)



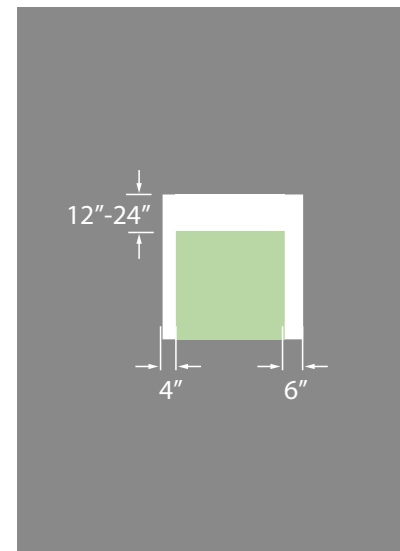
Mini Bike Symbol
(for bike parking areas)



Standard Dashed Line Marking



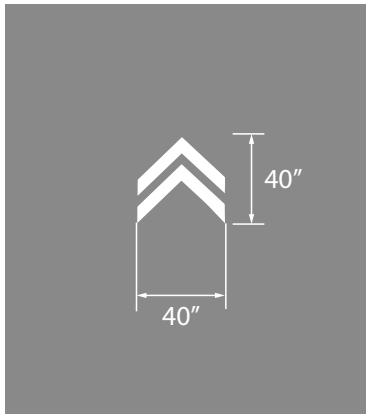
Bike Lane Yield Lines



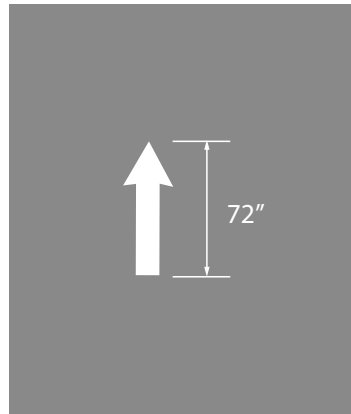
Bike Lane Stop Bar

DIRECTIONAL MARKINGS

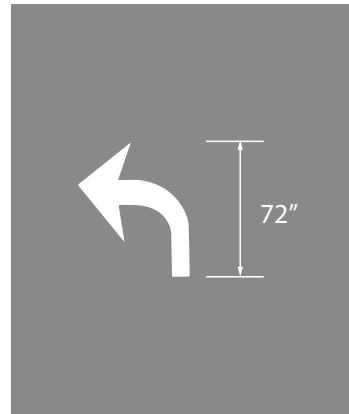
Directional markings are used to communicate to cyclists and other street users where bicycles are meant to travel in the street and in what direction(s). These include lanes of forward travel, turning lanes, and areas to wait at signalized intersections.



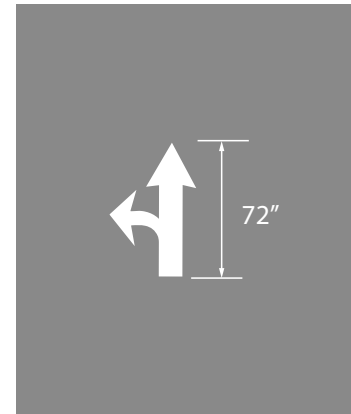
Chevron



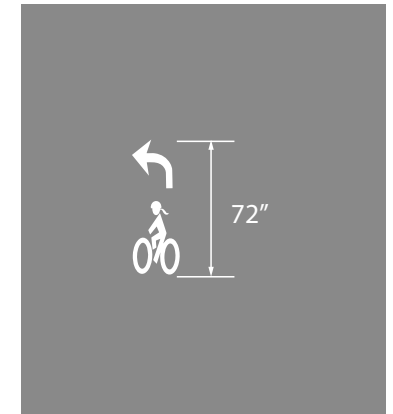
Directional Arrow



Directional Turn Arrow



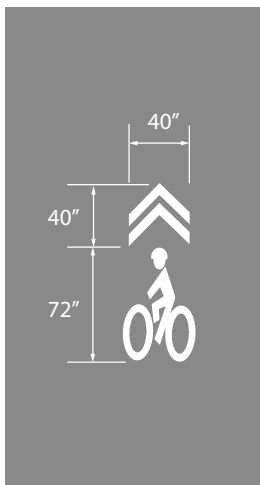
Combined Directional Arrow



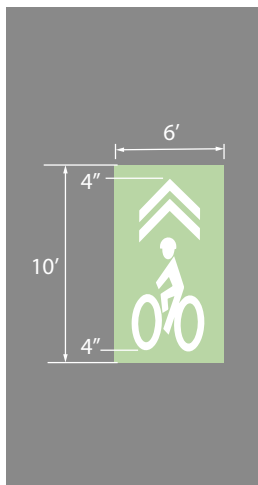
Directional Turn Symbol

SHARED LANE MARKINGS

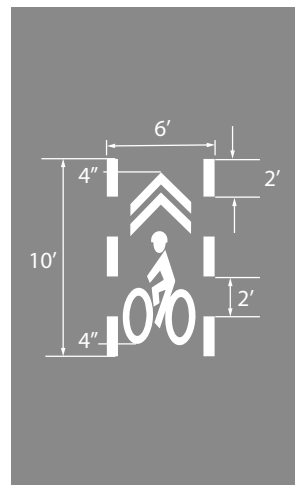
Shared lane markings are a combination of directional markings which form a symbol referred to as a "sharrow". These guide cyclists on where to position themselves within a travel lane they are sharing with motor vehicles, and communicate to people driving that they should expect to see cyclists and are required to yield the right-of-way to them.



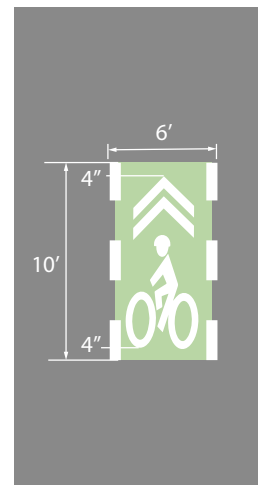
Sharrow



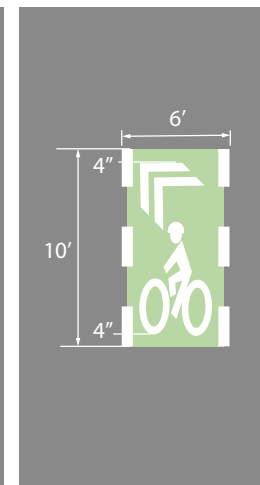
Green-Backed Sharrow



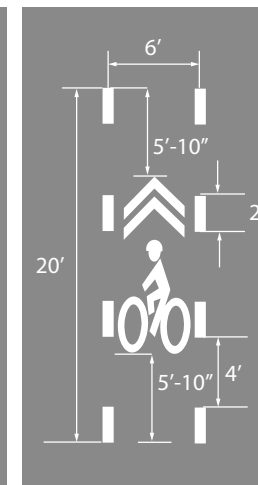
Super Sharrow



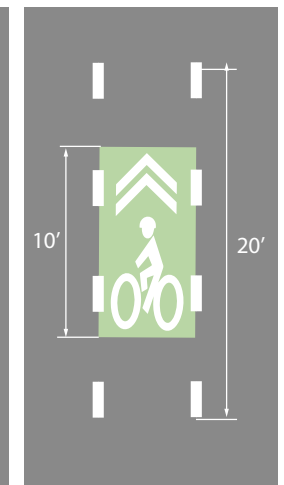
Green-Backed Super Sharrow



Directional Turn Green-Backed Super Sharrow



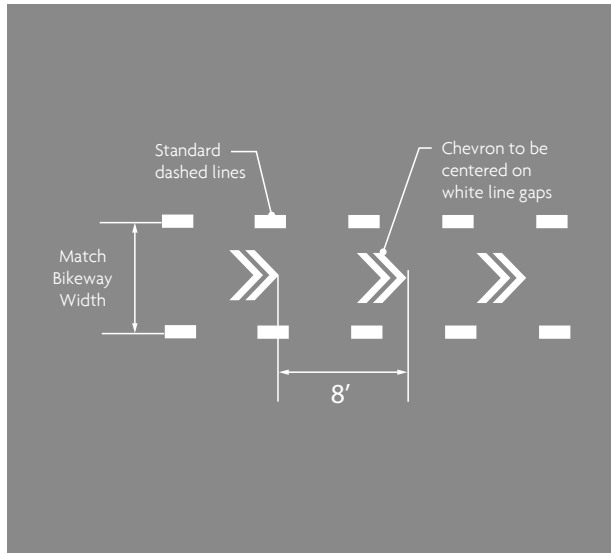
Super Sharrow (Option 2)



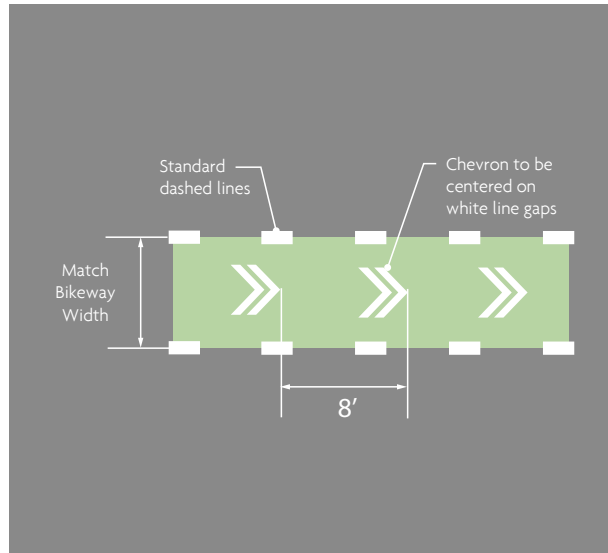
Green-Backed Super Sharrow (Option 2)

CROSSBIKE MARKINGS

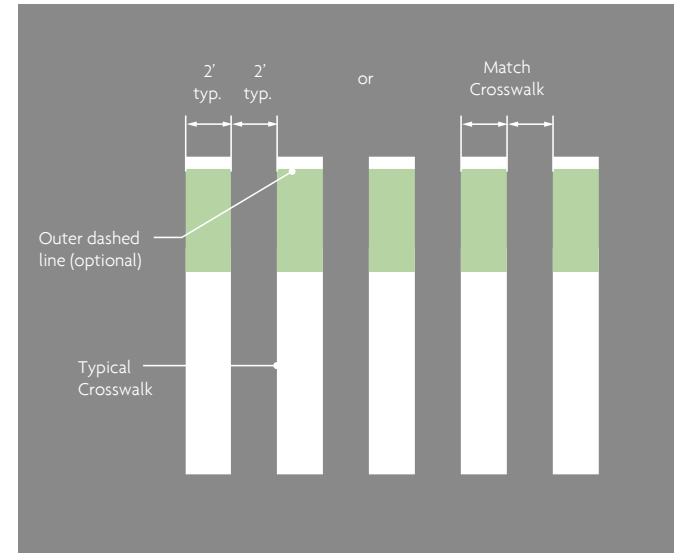
Crossbike markings are paired with bicycle lane and shared lane markings. They direct cyclists through a variety of conflict zones, including driveways and intersections. They are especially useful within irregular intersections, as they provide lateral guidance and increase the visibility of people cycling where they are most vulnerable to turning motor vehicles. Three styles of Crossbike markings are shown below, but the actual markings may vary based on the type of facility and the degree of conflict. For example, “Elephant’s Feet” markings (not shown), as found in FHWA and MUTCD guidance, may also be used. For more info on how and where to use crossbikes, see the Intersection Treatments chapter.



Conventional Crossbike Marking (typ.)
(For Low-Volume Intersections)



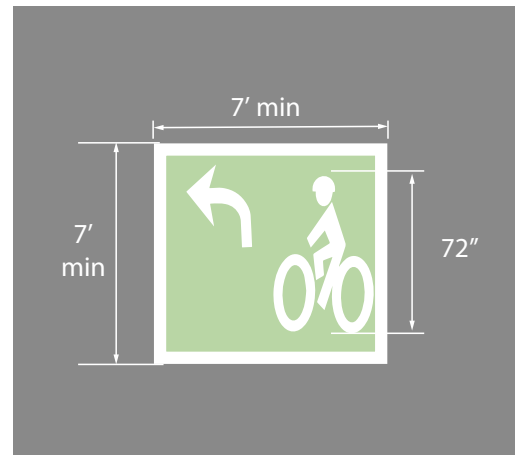
Green Crossbike Marking (typ.)
(For High-Volume Intersections)



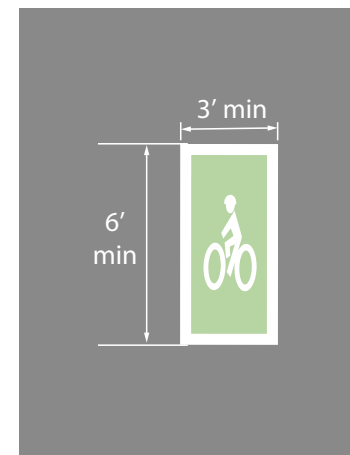
Green Crossbike Marking along Pedestrian Crosswalk
(For Off-Street Bikeways Intersecting Vehicular Lanes)

Queue Box Markings

Intersection queue box markings provide designated space for bicyclists, either at the front of the travel lane or in the middle of the intersection, to make turning movements through intersections.



Two-Stage Queue Box



Bike Refuge Area



Bike Box

2. UNPROTECTED BIKEWAYS



Bicycle lanes designate a space for cyclists in the right-of-way through the use of pavement markings and signage, typically adjacent to vehicle traffic traveling in the same direction. In this dedicated space, cyclists can travel at a speed at which they are most comfortable and, with appropriate enforcement, avoid interference from vehicle traffic. Bike lanes generally appeal to moderate or skilled cyclists but are unlikely to encourage inexperienced cyclists to ride because the level of traffic stress still makes cycling unappealing. Where the roadway width does not allow a full-size lane, a dashed line may be used to indicate that vehicles wheels may encroach on the lane when it is safe to do so (also known as an “advisory lane”). To increase comfort, a striped buffer may be added where space allows (see page 20 for more detail) and is the preferred treatment.

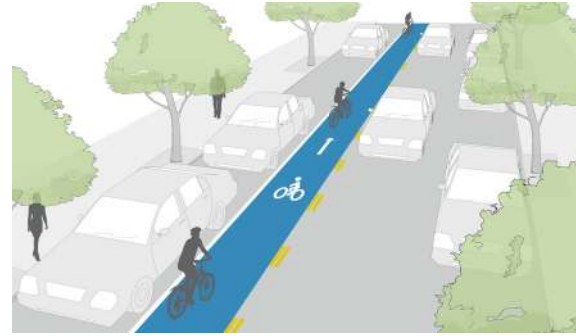
This section provides guidance on the following unprotected facilities (at right): conventional bike lanes (left and right sides), advisory lanes, buffered bike lanes, contra-flow bike lanes, and green-backed super sharrows (including full lane).

APPLICATIONS

Unprotected bikeways are an appropriate treatment for local bike network branches (as opposed to major connectors) and local streets with two or fewer vehicle travel lanes, moderate volumes (<3,000 ADT), and slower speeds (25mph or less). For streets with more travel lanes, high vehicular speeds or volumes, significant truck or bus traffic, or more width to work with, protected bikeways are recommended wherever possible.



A.
Conventional
Bike Lane
(Right Side)



D. Contra-Flow
Bike Lane



(Left Side)



E. Green-
Backed Super
Sharrows



B. Advisory
Lane



(Full Lane)



C. Buffered
Bike Lane

The guidance on pages 14-16 provide the most basic components, dimensions, and detail that comprise unprotected bikeways, followed by additional guidance for facilities B-E.

BASIC COMPONENTS: ALL UNPROTECTED BIKEWAYS



Required

- Standard MUTCD bikeway pavement marking
- Retroreflective dashed or solid striping demarcating the outside of the bicycle lane, as well as the inside where parallel parking is present

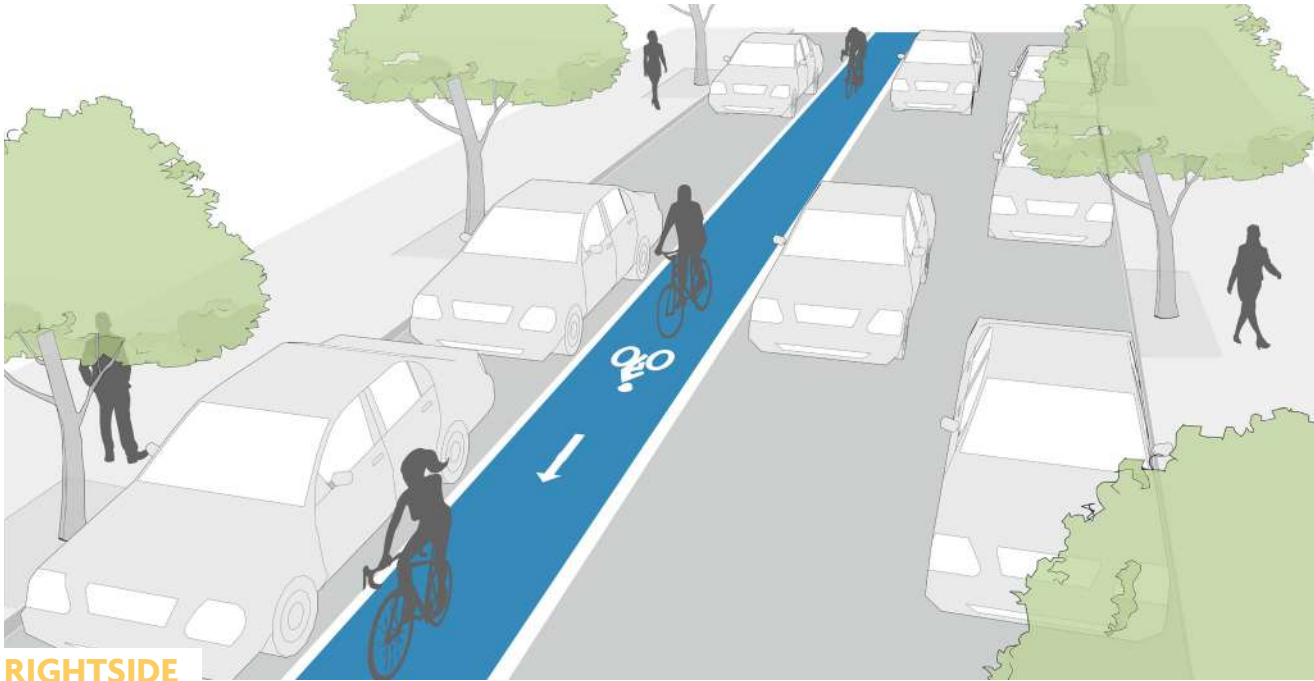
Recommended

- Crossbike markings (see page 88)
- Stop bar
- Striped buffer between the bike lane and moving vehicles, parked vehicles, or both wherever conditions allow
- Bike box (where bikeways intersect or left turns are common, see page 90)
- Green retroreflective paint over bike lanes with appropriate markings

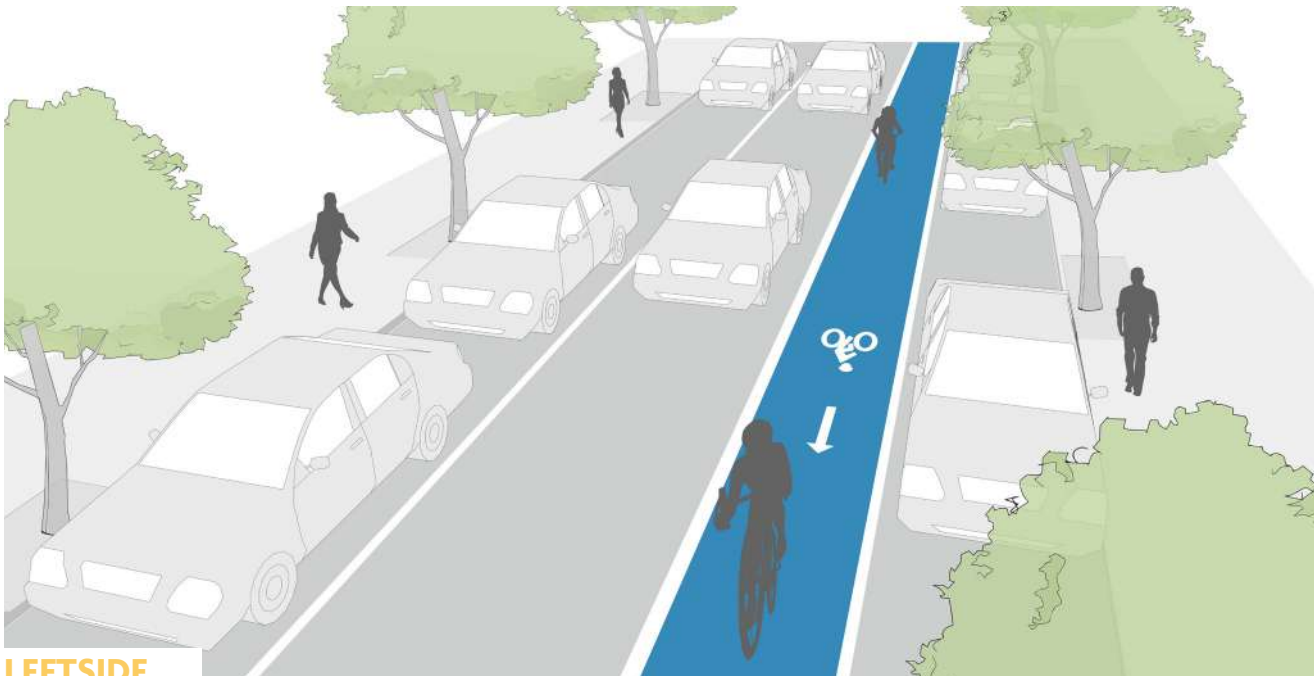
Optional

- Retroreflective dashed or solid striping demarcating the inside stripe of a curbside bicycle lane
- Directional turn arrow
- Yield Line markings
- Left or right-turn pocket / queuing area
- Standard MUTCD bikeway pavement marking with ponytail or other details that offer more representation

DESIGN DIMENSIONS: ALL UNPROTECTED BIKEWAYS



RIGHTSIDE



LEFTSIDE

Required

- 5' minimum bike lane width for all one-way conventional bike lanes (4' acceptable only for curbside bike lanes where constrained conditions on low-volume streets are present).
- For buffered bike lanes, a combined minimum bikeway width of 8' shall be achieved, with 5' required for the bike lane and a minimum of 3' provided for the bike lane buffer.
- A combined bikeway width of 7' is acceptable only in constrained conditions, with 5' required for the bike lane and 2' allocated for the bike lane buffer if adjacent to vehicular travel lane; 3' minimum, 2' acceptable in constrained conditions adjacent to parking lane only if the 5' minimum bike lane width is maintained. See page 20-21 for additional marking and design guidance.

Recommended

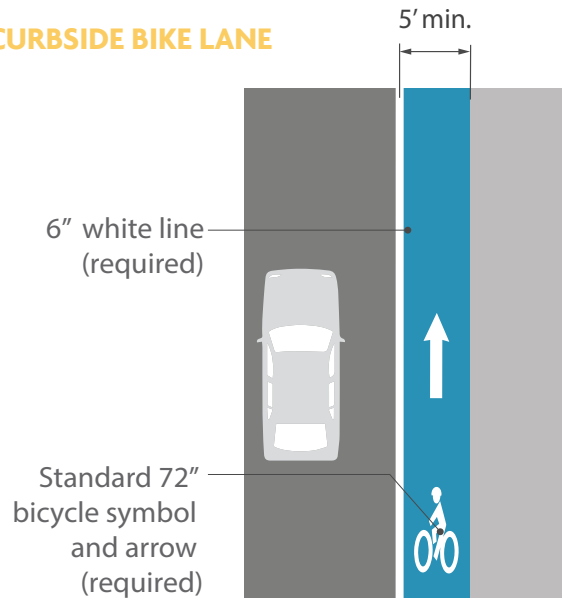
- Double white stripes demarcating the outside edges of the bike lane
- 12"- 24" stop bar at intersections
- Crossbike markings (see page 11 for dimensions)
- Directional turn arrow (see page 10 for dimensions)
- See the Shared Active Mobility Chapter for further discussion on optimal lane widths

Optional

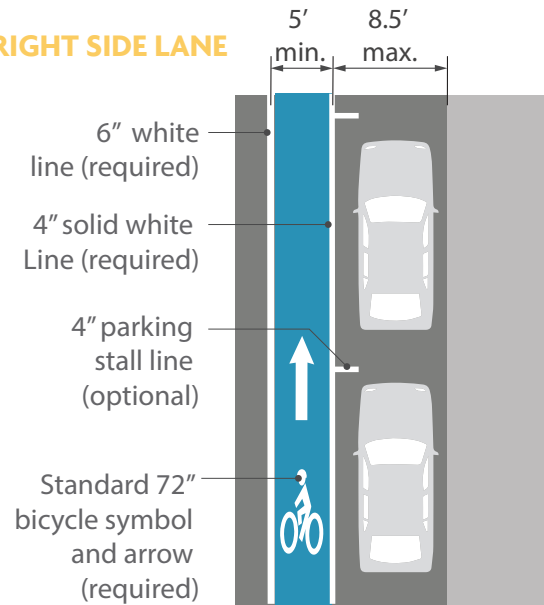
- 6" diagonal buffer stripes @ 45° with 10' - 15' gaps

TYPICAL DETAILS: ALL UNPROTECTED BIKEWAYS

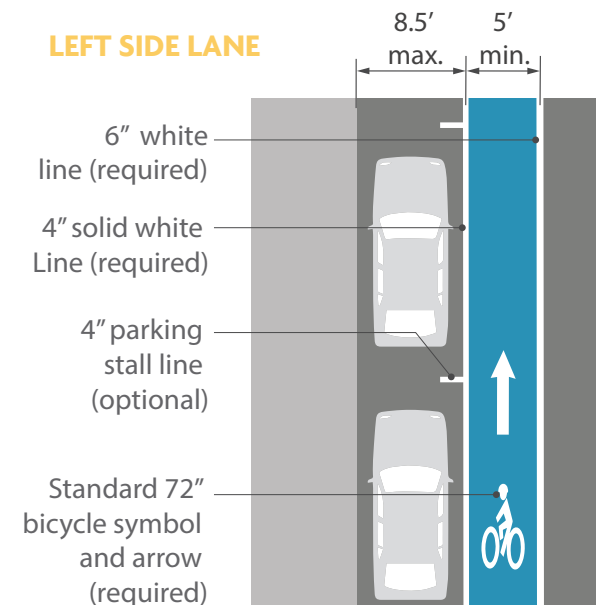
CURBSIDE BIKE LANE



RIGHT SIDE LANE



LEFT SIDE LANE



DESIGN NOTES

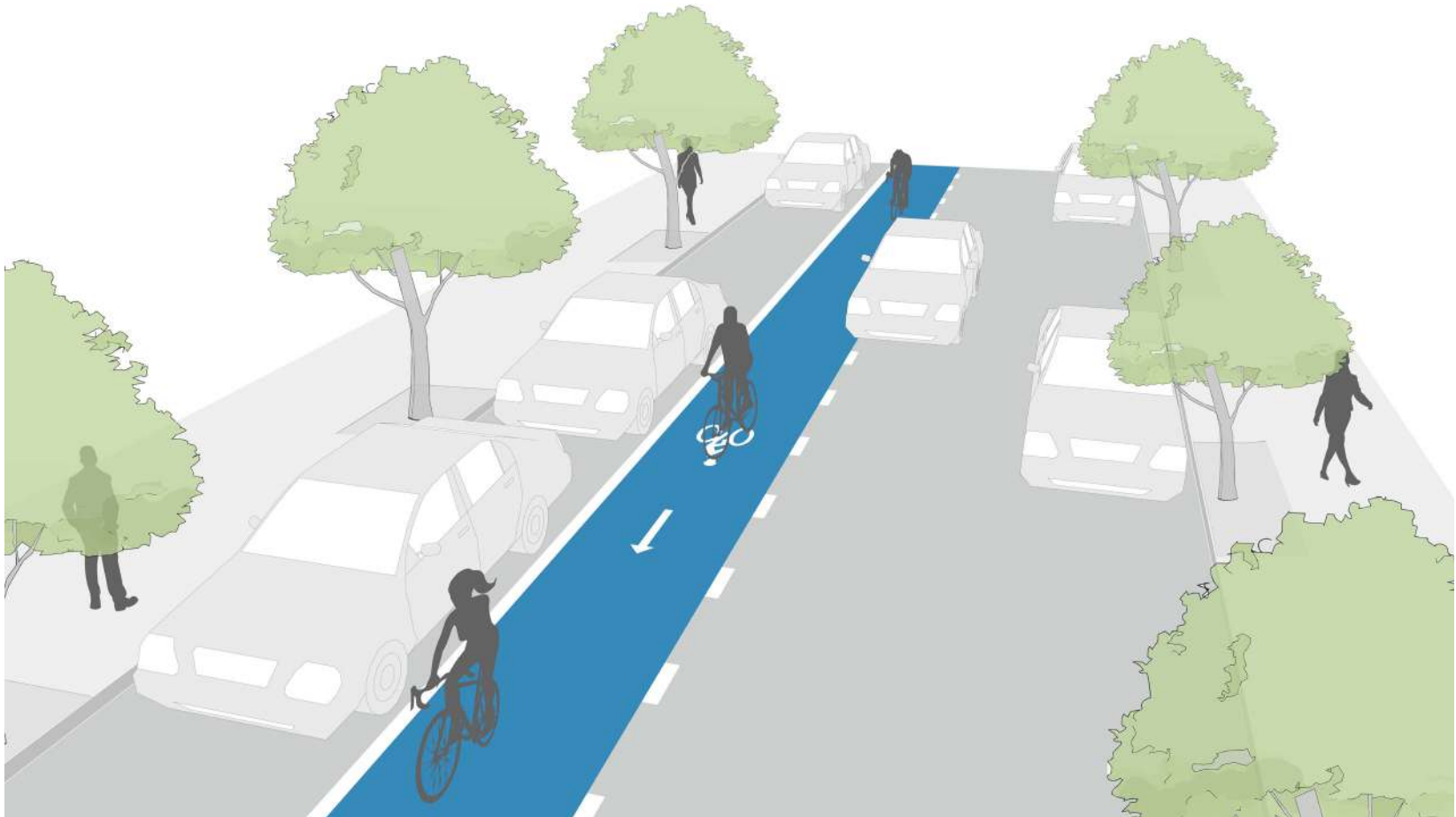
- Directional arrows should accompany all bikes lanes to reinforce the legally required direction of travel.
- Bicycle lanes of any type should be made wider than minimum widths wherever possible, however overly wide bicycle lane widths may encourage wrong-way riding, illegal parking, or motor vehicle use of the bike lane.
- Bicycle lanes are typically located on the right side of the street, between the adjacent travel lane and curb, road edge, or a parking lane. However, it is recommended that bicycle lanes be placed on the left side when installed along one-way streets to decrease 'dooring' potential.
- Wherever possible, the parking lane width should be marked at the minimum width so that the bike lane width may be maximized.
- Contra-flow lanes should be marked with clear signing and a double yellow line separating the bicycle lane from the motor vehicle travel lane.
- Bicycle lane symbols and/or arrow markings shall be placed outside of the motor vehicle tread path at intersections, driveways, and merging areas in order to minimize wear from the motor vehicle path; the curb radius will determine specific placement but typically 10' - 15' beyond the radius edge.
- Where irregular intersections or jogs in the route exist, turn arrow markings may be used to help people navigate along a specific route or turn onto an intersecting bikeway.
- See NACTO's Bikeway Design Guide for more design guidance.



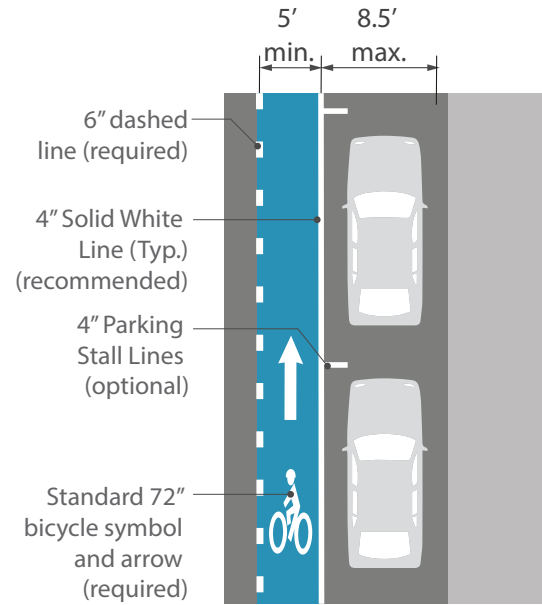
Flynn Avenue Advisory bike lanes,
Burlington, VT (Street Plans)

2b. Advisory Bike Lanes

Advisory lanes may be an appropriate treatment for limited situations where a bikeway or bikeway connection is desired and there is not adequate street width to provide both a full-size bicycle lane and a vehicle travel lane, but where traffic speeds or volumes preclude shared lanes. In these instances, a bike lane can be installed where the outside stripe is dashed, indicating that vehicles may drive over it if necessary, but they should watch for and yield cyclists as with any bicycle facility. This treatment is not recommended for long distances or major network nodes - it is essentially a design approach where insurmountable challenges prevent more robust facilities from being installed, or an opportunity to create wider bike lanes along narrow, low-speed, low-volume residential streets that may experience higher than average ridership.



ADVISORY BIKE LANE DETAILS

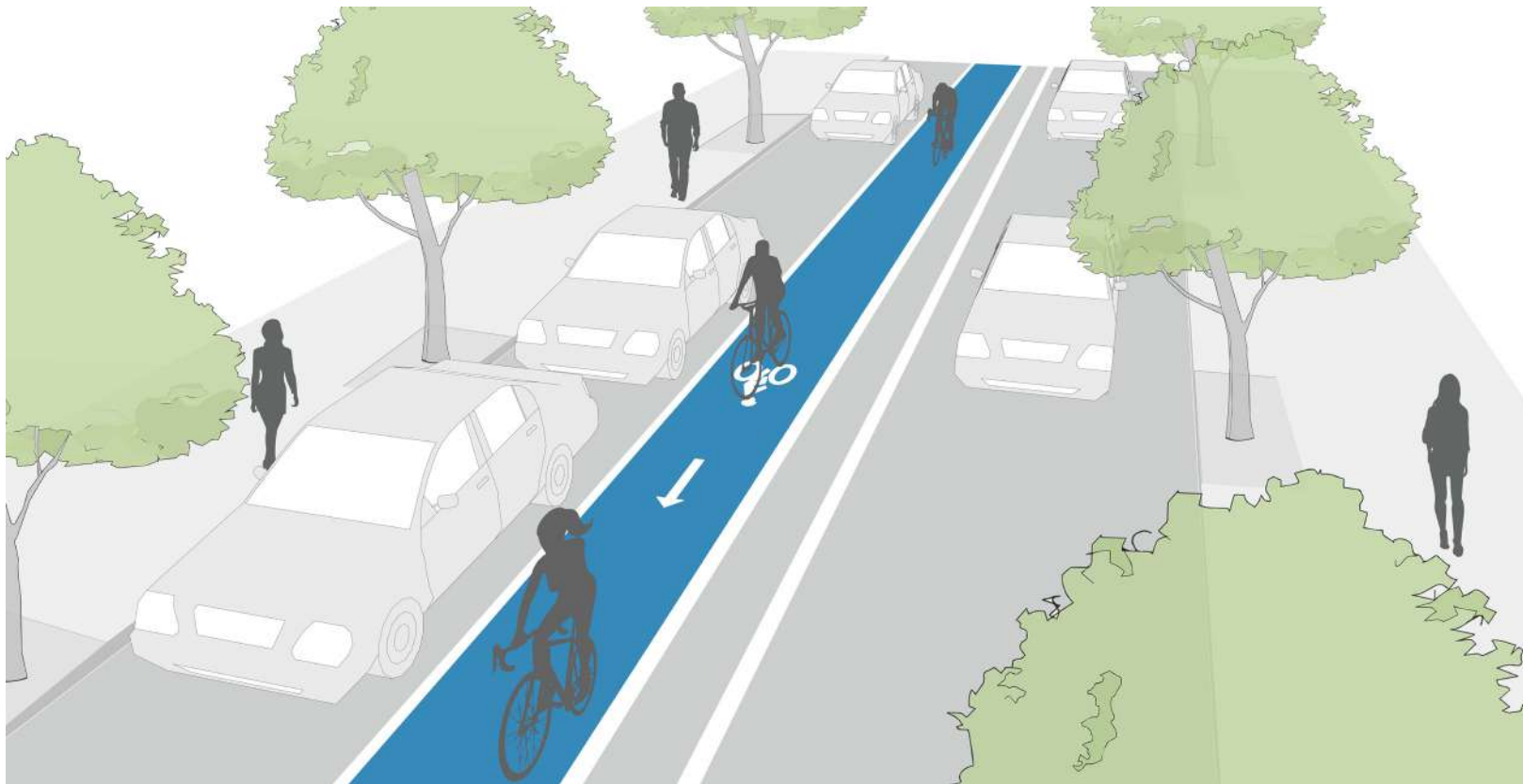


ADDITIONAL DESIGN GUIDANCE

- Requires bicycle symbol and arrow markings, and at least two solid white lines between vehicular traffic and the bike lane.
- Dashed outside striping to indicate an “advisory lane”.
- 6' minimum width, 7' recommended.
- Should include cross-bike markings or colored paint treatments at intersections, curb cuts, or other known conflict points.

2c. Buffered Bike Lanes

Buffered bike lanes have the same basic configuration and design as conventional on-street bicycle lanes, only they include a striped buffer space separating the bicycle lane from the adjacent vehicular travel and/or parking lane. This provides increased physical distance between cyclists and vehicles where space allows, giving cyclists a greater sense of safety and comfort than conventional lanes.

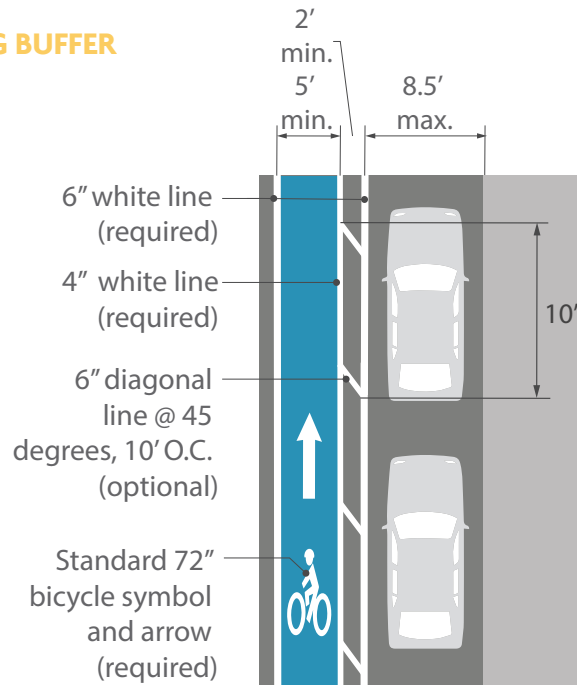


APPLICATIONS

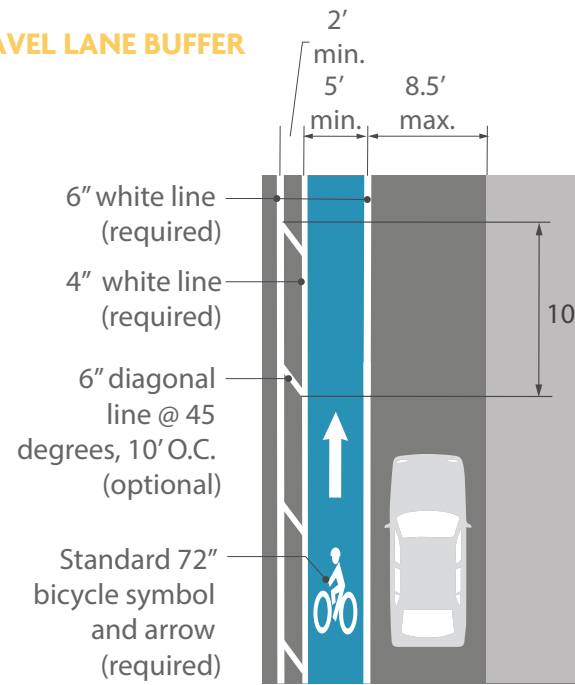
Buffered bike lanes are recommended as the default design wherever conventional bike lanes are being installed, but are especially advised for higher-speed or high-traffic corridors, such as those with a design / posted speed that exceeds 25 mph or where traffic volumes are greater than 3,000 vehicles per day. Any thoroughfares with excess capacity are ideal for buffered bike lanes, as existing travel lanes may be narrowed or removed, with the extra space given to buffered bike lanes. This not only provides better facilities for cyclists, but narrowing and removing vehicle travel lanes reduces speeding and improves safety for people walking as well.

BUFFERED BIKE LANE DETAILS

PARKING BUFFER



TRAVEL LANE BUFFER



ADDITIONAL DESIGN GUIDANCE

- Requires bicycle symbol and arrow markings, and at least two solid white lines between vehicular traffic and the bike lane.
- The striped bikeway buffer shall be 3' minimum, except in constrained conditions where it may be a minimum of 2' wide if the bike lane meets 5' minimum width standard.
- If the buffer zone is 3 feet or wider, chevron or diagonal hash pavement markings may be used.
- Like conventional bike lanes, buffered lanes may include cross-bike markings or colored paint treatments at intersections, curb

2d. Contra-flow Bike Lanes

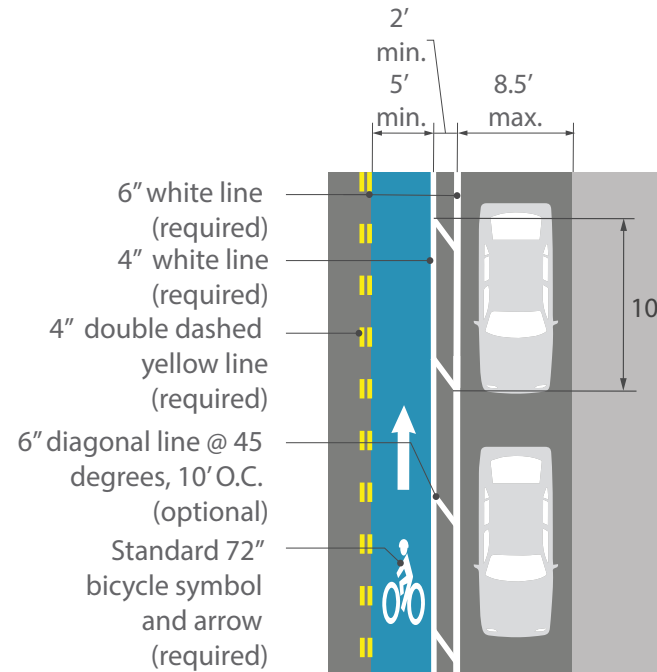
Contra-flow bike lanes direct cyclists to travel in the opposite direction of motor vehicle traffic, usually on a one-way street. This effectively makes a one-way street into a two-way street: one direction for people cycling and driving, and another direction for cycling only. Contra-flow bike lanes allow for continuous travel along a corridor where the direction of vehicle traffic flow alternates, or anywhere where “wrong-way” cycling is commonly observed on the street or sidewalk. Contra-flow bike lanes require careful designing as they can introduce additional conflict points where people driving and people walking may not expect oncoming bicycle traffic.



APPLICATIONS

Contra-flow bike lanes are most appropriate for low-speed, low-volume, and shorter segments that facilitate a needed connection between two otherwise disparate bikeways, especially where alternate bikeway routes require inconvenient or unsafe “out-of-direction” travel. They are also appropriate when the contra-flow lane provides direct access to a popular destination(s) on the corridor (park, school, transit station etc.).

CONTRA-FLOW BIKE LANE DETAILS

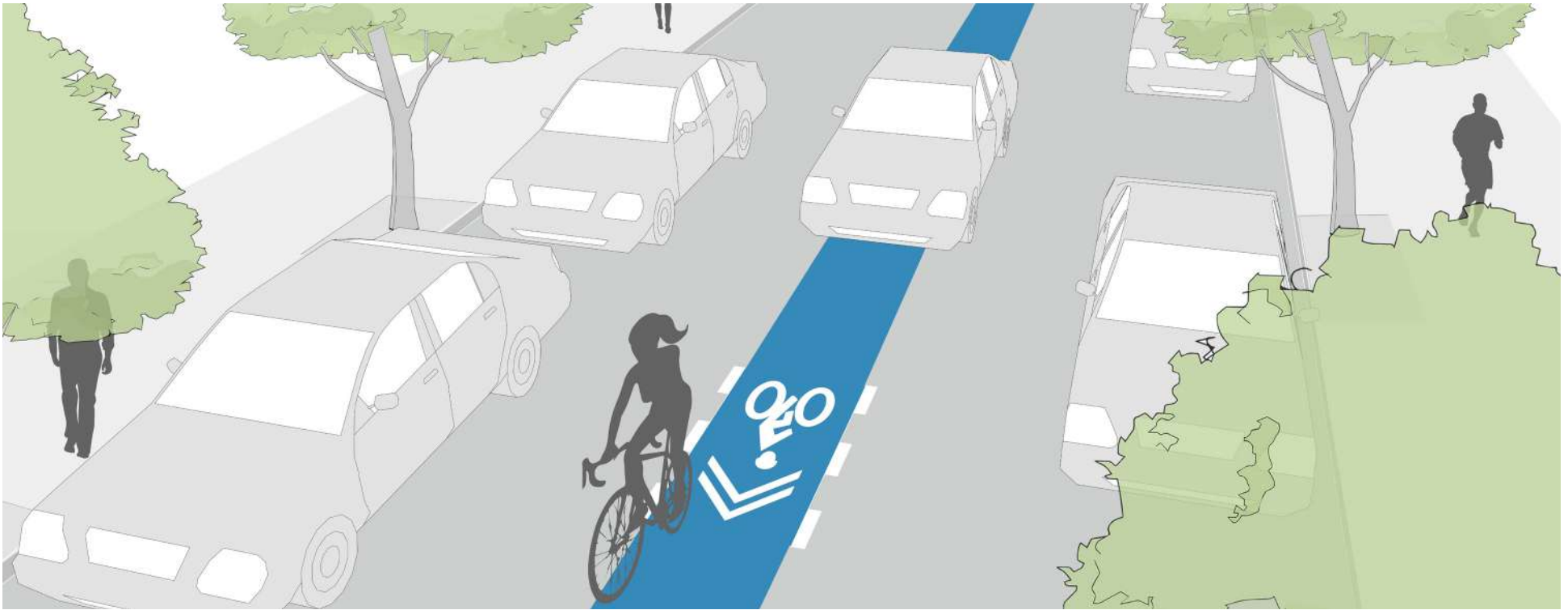


ADDITIONAL DESIGN GUIDANCE

- Requires bicycle symbol, directional arrow markings, and yellow center line striping to separate opposite directions of motor vehicle traffic.
- Yellow center line striping may be dashed to allow vehicles to cross over to a parking lane.
- Directional signage and traffic signals along the corridor must be configured to reflect the contra-flow lane.
- Physical protection, vertical barrier elements delineators, and/or a buffer should be used wherever space allows.
- Green-colored lane markings are recommended, especially approaching and through conflict zones.
- Like conventional bike lanes, contra-flow lanes may include cross-bike markings or colored paint treatments at intersections, curb cuts, or other known conflict points.
- Because contra-flow cycling can be unexpected to vehicle drivers and passengers, special consideration should be taken before installing them adjacent to parking lanes where “dooring” conflicts exist.

2e. Green-Backed Super Sharrows

Green-backed super sharrows are a pavement marking used to indicate a lane for people bicycling shared within a vehicular driving lane. Two parallel dashed line markings are intended to emphasize cyclist priority along designated streets. Like regular shared use lane markings (“sharrows”), super sharrows should not be considered a substitute for dedicated bike infrastructures, such as bicycle lanes or protected bikeways, and should only be used in conjunction with other traffic-calming interventions, or as a short, visual connection between more robust bikeway types.



APPLICATIONS

Super sharrows are an appropriate treatment for Neighborhood Greenways (see page 58) or other short street segments that are low speed and low-volume connections (preferably 3 blocks or less) between more robust bikeways.

BASIC COMPONENTS: GREEN-BACKED SUPER SHARROWS



Green-Backed Super Sharrows along the Old North
End Neighborhood Greenway, Burlington, VT
(Street Plans)

Required

- Standard MUTCD shared use lane pavement marking
- White retroreflective solid dashed traffic paint, thermoplastic, or traffic tape striping
- Green retroreflective traffic paint

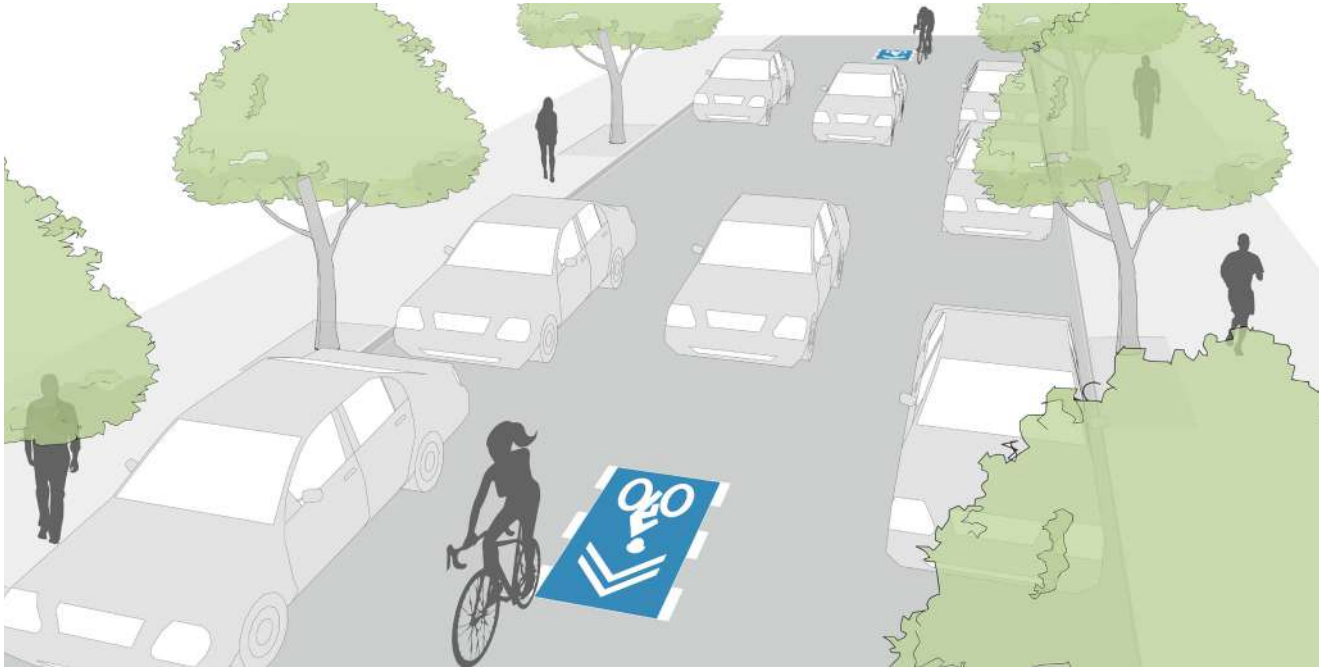
Recommended

- Continuous green-painted lane
- Mid-block center line removal on two-way streets should be considered for all designated neighborhood greenway streets
- Angle chevrons to indicate approaching turns/jogs in the Neighborhood Greenway route

Optional

- “Stop” markings may be placed in conjunction with stop bars

DESIGN DIMENSIONS: GREEN-BACKED SUPER SHARROWS



Required

- Super sharrows shall be marked using the dimensions detailed on page 10 of this guide
- The center of the super sharrow marking shall be placed at a minimum of 4' from the curb face where on-street parking is not present; at least 11' from the curb face where parallel parking is present; or in the center of the travel lane, especially where angled on-street parking exists
- Super sharrows shall be spaced at minimum of 100' apart except on very short blocks where closer spacing may

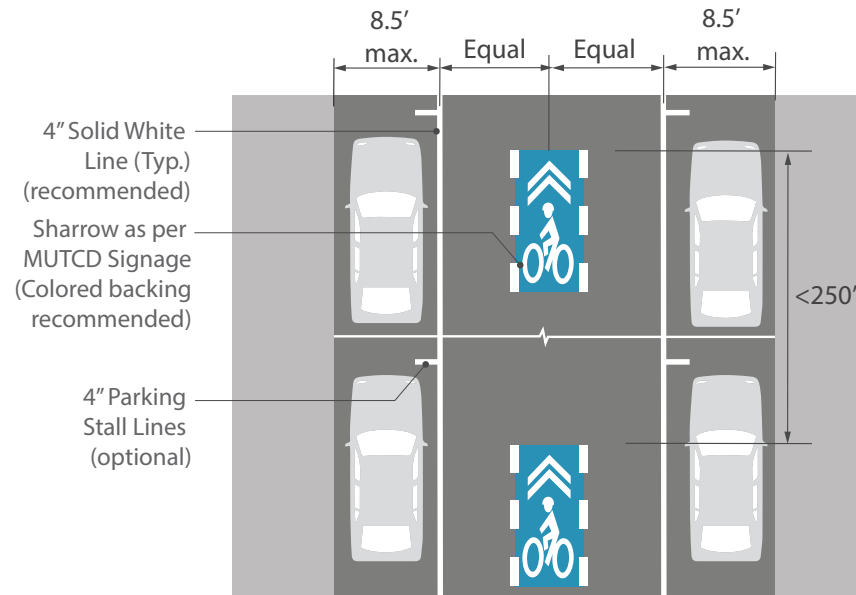
Recommended

- Markings should be placed no more than 30' from the stop bar (ingress) / 15' from the bottom of the crosswalk (egress)
- Super sharrows should be placed in the center of the travel lane when applied to all neighborhood greenway streets

Optional

- N/A

GREEN-BACKED SUPER SHARROW DETAILS



ADDITIONAL DESIGN GUIDANCE

- Continuous green-backed lane should be used whenever feasible.
- Along short blocks (<300') with bi-directional travel lanes, there should be a minimum of four markings, two per travel lane.
- One-way streets shall include a minimum of two markings, placed at either end of the block.
- For bi-directional streets, markings shall be placed in pairs where possible. (Short blocks, offset block links, or driveways may make exact placement impractical).
- Where possible, super sharrow marking centerline should be placed within the center of the travel lane to prevent wheel tracking deterioration and to encourage people to “take the lane” and bicycle outside of the door zone.
- Where parking lanes are unmarked, the super sharrow marking centerline should be a minimum of 12' from the curb face.
- Directional arrows may be placed in conjunction with super sharrow markings to help direct people bicycling along the Neighborhood Greenway route where irregular intersections / jogs in the cycling network exist.

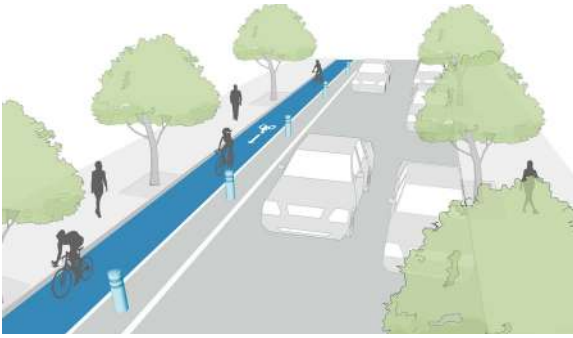
3. PROTECTED BIKEWAYS



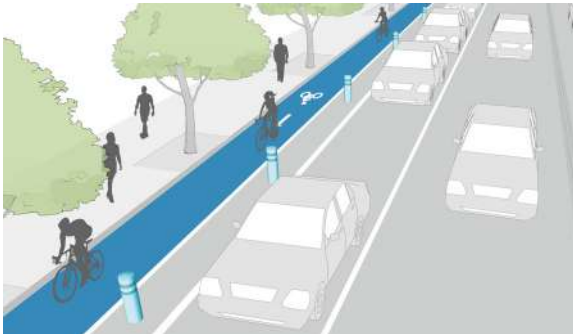
Protected bikeways provide vertical and/or horizontal separation between people bicycling and people driving, and employ any of a variety of physical barriers, such as raised curbs, bollards, parked cars, concrete barriers, or move lanes off the street entirely. They offer the maximum comfort and therefore the most appeal to the widest number of people and, as such, protected bicycle lanes should be implemented wherever possible as conditions allow. Protected bikeways may be one-way or two-way to allow for bicycle movement in both directions on one side of the street. Two-way bikeways require some additional considerations at conflict zones where contra-flow bike traffic might not be expected by other street users.

APPLICATIONS

Protected bike lanes are preferred for all streets where they can be reasonably accommodated, and are especially advised for streets with high volumes of bicycle and/or motor vehicle traffic (e.g. > 5,000 ADT), and on streets where cyclists feel unsafe due to posted or actual high vehicle speeds (> 25 mph), high parking turnover, and/or multiple travel lanes. Wherever there are concerns about cyclists experiencing frequent conflicts with motor vehicles, protected bike lanes should be considered even if just for a short stretch, for example at the approach to an intersection or where illegal parking in a bike lane is frequently observed. See Let's Ride JC Bike Master Plan for recommended locations.



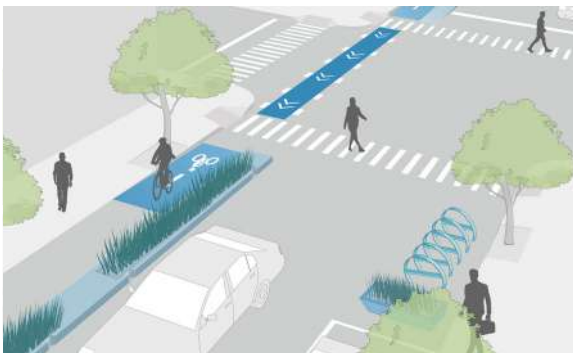
A. Curbside
Barrier
Protected
Bike Lanes



B. Parking-
Protected
Bike Lanes



C. Two-Way
Protected
Bike Lanes



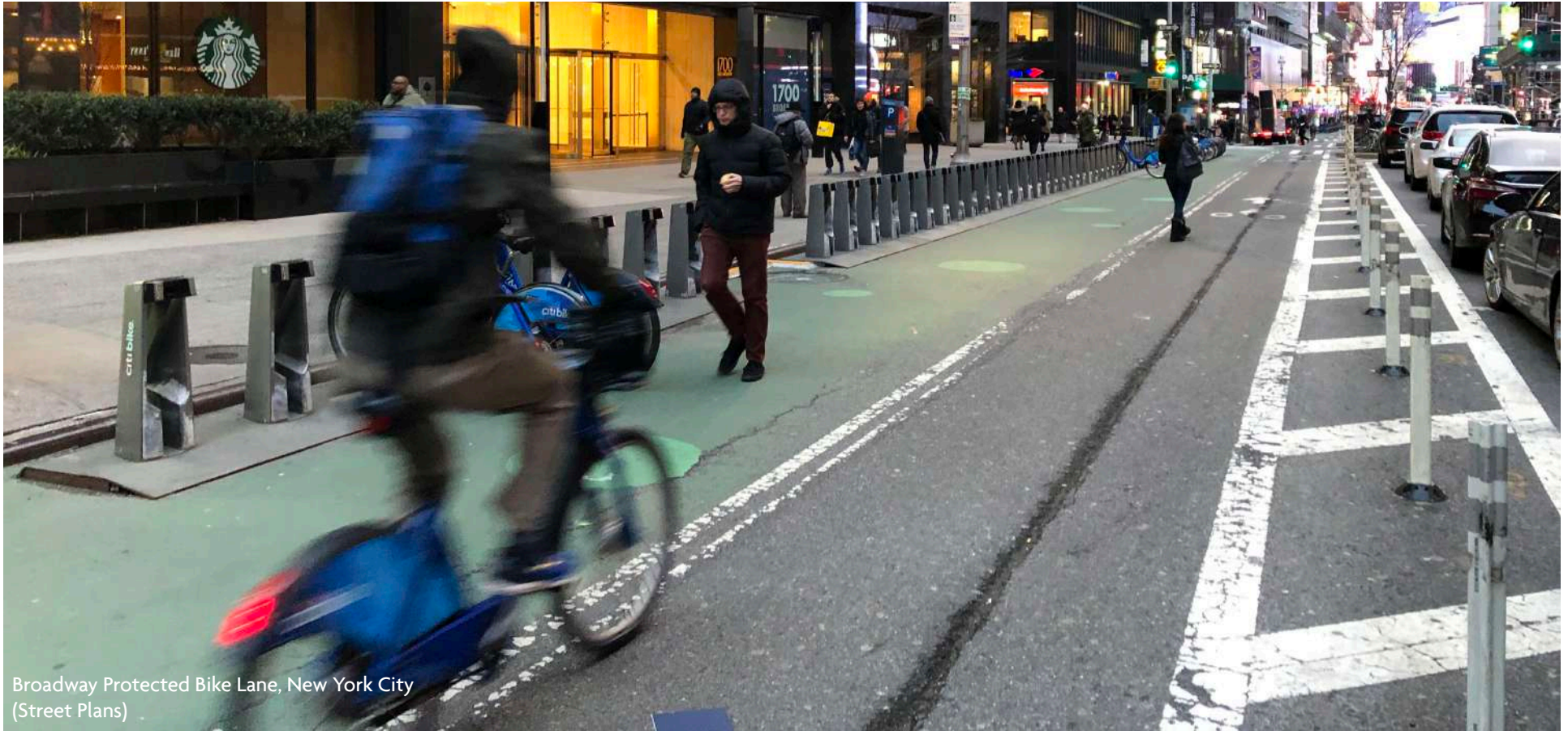
D. Raised
Bike Lanes



E. Off-Street
Paths

The guidance on pages 30-32 provide the most basic components, dimensions, and detail that comprise protected bikeways, followed by additional guidance for facilities B-E.

BASIC COMPONENTS: ALL PROTECTED BIKEWAYS



Broadway Protected Bike Lane, New York City
(Street Plans)

Required

- Standard MUTCD bikeway pavement marking
- Retroreflective dashed or solid striping demarcating the inside and outside stripe of the protected bicycle lane
- Vertical barrier element (parked car, vertical delineators, planters etc.)

Recommended

- Bike box (see page 90)
- Crossbike markings (see page 88)
- Stop bar at controlled intersections
- Green retroreflective paint over bike lanes with appropriate markings

Optional

- Directional turn arrows
- Yield Line markings at pedestrian crossings
- Left or right-turn pocket / queuing area
- Surface treatments / murals may be incorporated into some project elements, like bikeway buffers
- Standard MUTCD bikeway pavement marking with ponytail or other creative additions that do not reduce legibility.

DESIGN DIMENSIONS: ALL PROTECTED BIKEWAYS



Required

- For one-way, directional protected bike lanes, a combined minimum bikeway width of 8' shall be achieved, with 5' required for the bike lane width (6' or greater desired, especially where lanes are intended to accommodate higher volumes of other users such as scooters, skateboarders, etc.) and a minimum of 3' provided for the bike lane buffer.
- A combined protected bikeway width of 7' is acceptable only in constrained conditions, with 5' required for the bike lane and a 2' allocated for the bike lane buffer/barrier if adjacent to a vehicular travel or a parking lane.
- For two-way protected bikeways, a combined minimum width of 11' is required; with a minimum of 8' required for the two-way bike lane and 3' provided for the buffer. A combined two-way protected bikeway width of 10' is acceptable only in constrained conditions, with 8' required for the two-way bike lane and 2' allocated for the buffer/barrier adjacent to a travel or parking lane.

Recommended

- 1' stop bar

Optional

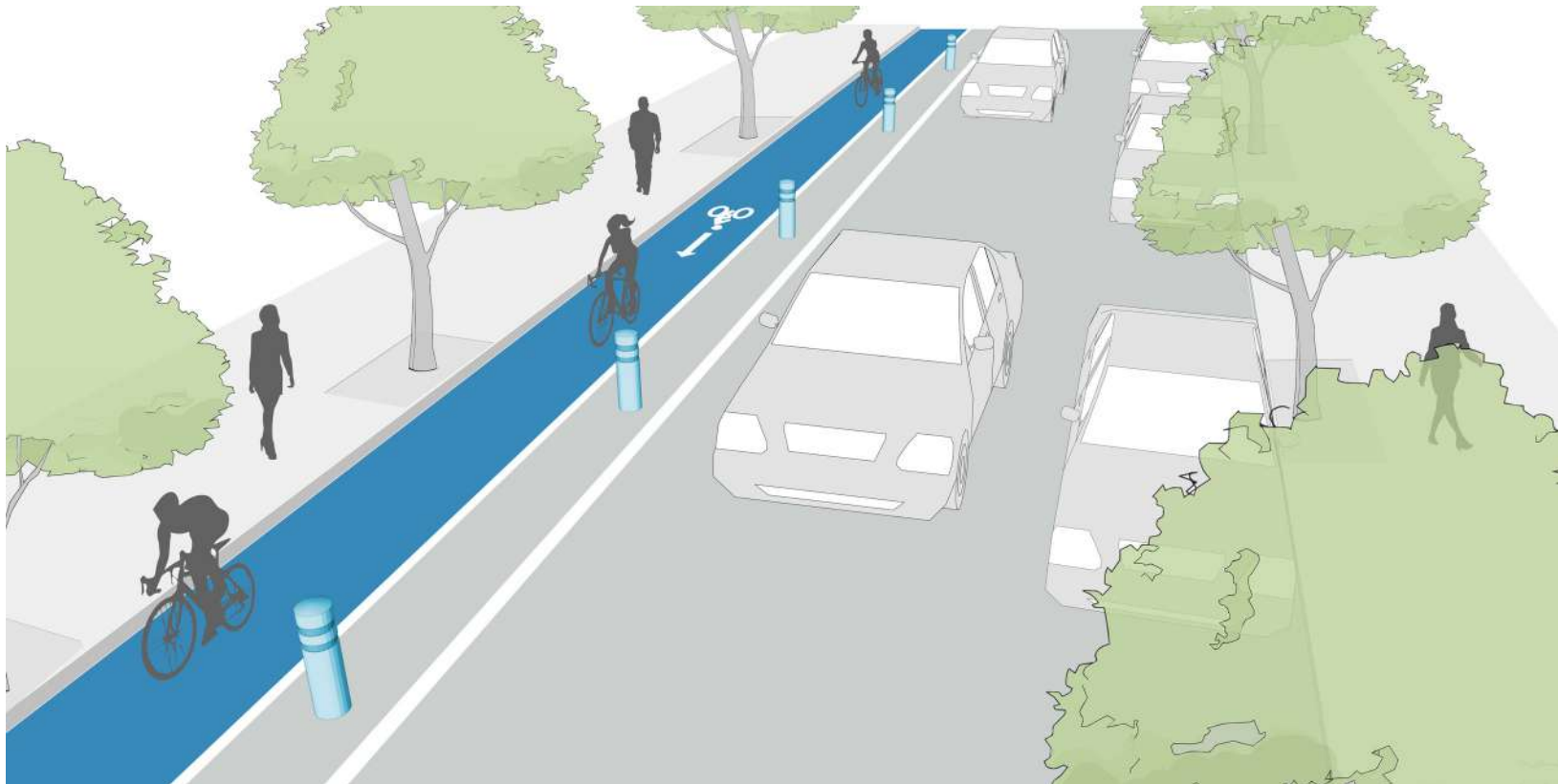
- See page 10 for all optional striping and marking dimensions
- 6" diagonal buffer stripes @ 45° with

DESIGN NOTES

- No vertical barrier elements to be placed within 10' of driveways.
- Except for the use of planters in appropriate locations, vertical barrier elements should be mountable by emergency response vehicles.
- Where two-way street width allows for only one protected lane, it is recommended that it be installed on the uphill direction where topographical grades exceed 2%.
- Where possible, contra-flow lanes should include vertical barrier elements.
- See NACTO's Bikeway Design Guide or FHWA's Separated Bike Lane Planning and Design Guide for more detailed design guidance.

3a. Curbside Barrier-Protected Bike Lanes

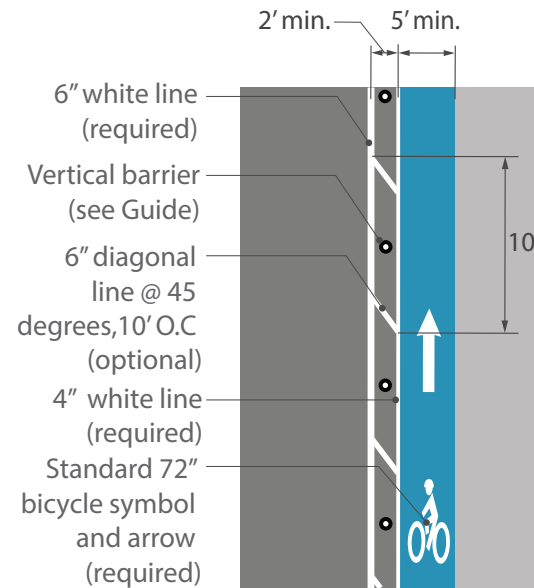
Curbside barrier-protected bike lanes offer physical protection for people cycling and prevent drivers from parking in the bike lane which would force cyclists to make a dangerous maneuver into moving traffic. The design combines a curbside bike lane and a buffered bike lane, and then adds physical protection which can be anything from plastic bollards to concrete barriers. This is especially useful in areas where the need for a dedicated bike facility is high but the roadway width is significantly constrained such that the demand for curbside vehicle parking cannot be accommodated.



APPLICATIONS

Curbside barrier-protected bike lanes are the recommended treatment for all curbside bike lanes in the roadway where parking is prohibited. This treatment is common where one side of the street does not have building entrances such as along a park or waterfront. See JC Bike Master Plan for recommended locations.

CURBSIDE BARRIER-PROTECTED BIKE LANE DETAILS

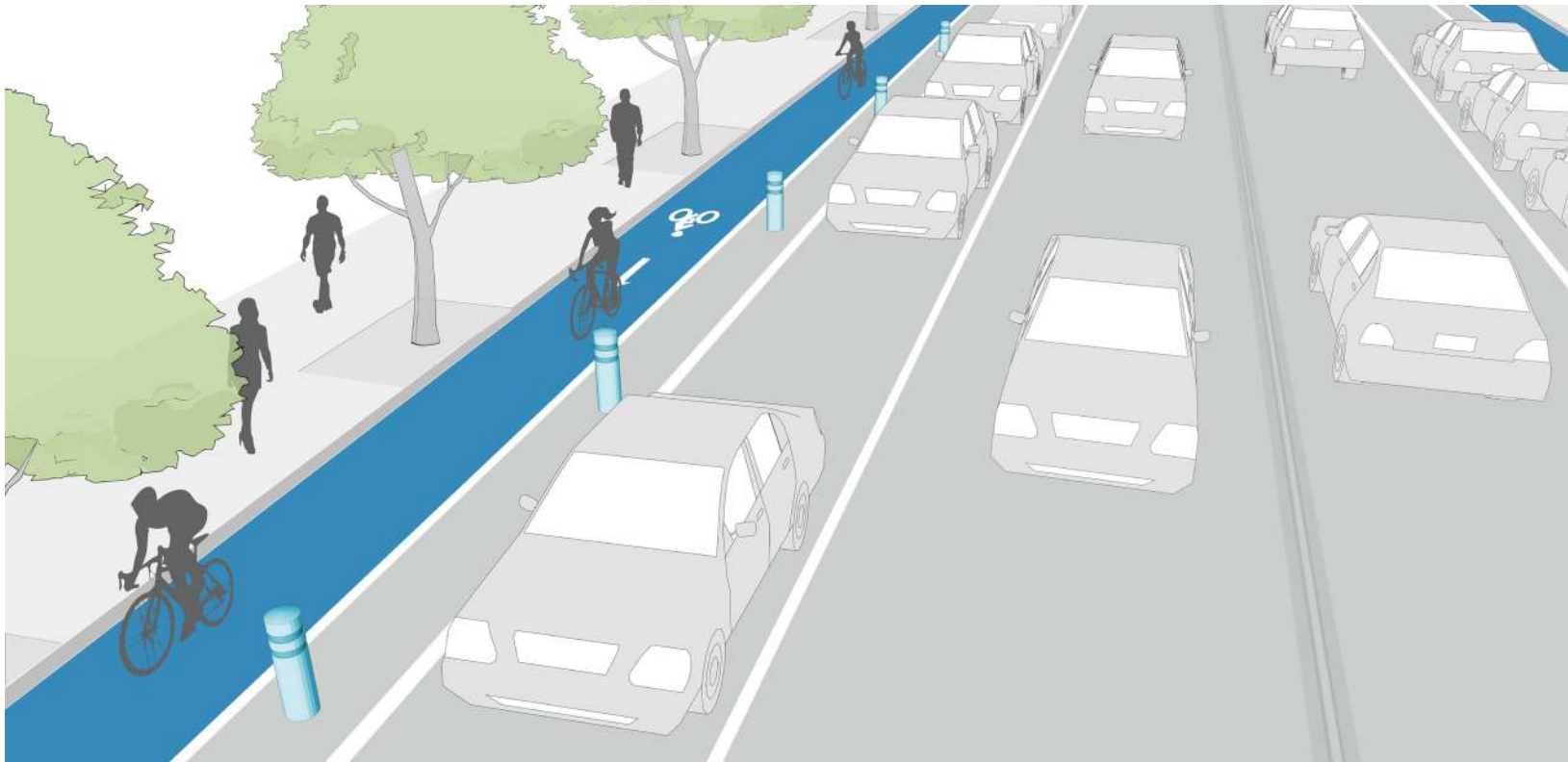


ADDITIONAL DESIGN GUIDANCE

- The recommended minimum bikeway width for a curbside lane is 7', 5' allocated to the protected bike lane and 2' provided for the buffer. This minimum width is acceptable only in constrained conditions.
- Bike markings and directional arrows should be painted, with green backing if possible.
- 6" retroreflective solid striping should demarcate the outside stripe of the protected bicycle lane.
- Use bike lane signage to discourage driving and parking in the bike lane.
- Vertical barriers such as bollards, delineators, or planters should be spaced no further than 15' apart.
- Special consideration must be given to street cleaning and snow removal.

3b. Parking-Protected Bike Lanes

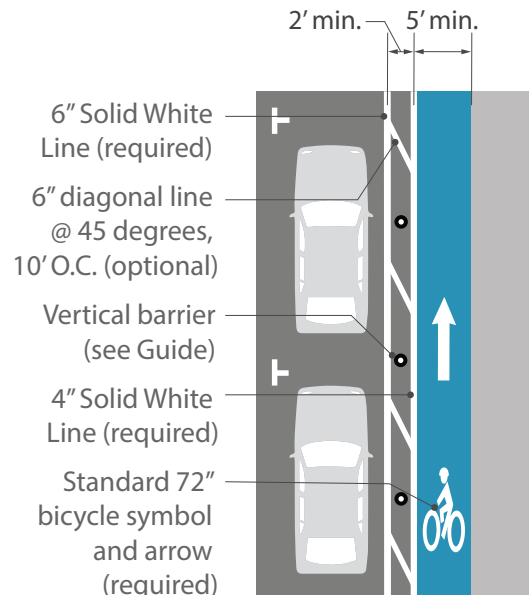
A parking-protected bike lane places the bike lane along the curb with the vehicle parking on the outside edge, thus the parked cars serve as a physical barrier between cyclists and motor vehicle traffic. This provides a first-rate cycling facility while maintaining on-street parking for vehicles where necessary. Parking-protected lanes should include a 3-foot buffer and ideally some additional physical barrier such as planters, bollards, or other delineators.



APPLICATIONS:

Parking-protected bike lanes are the recommended treatment for all curbside bike lanes in the roadway on streets where parking is allowed on both sides. Priority should be given to bikeways which are major network connections and where there are documented safety issues. See JC Bike Master Plan for recommended locations.

PARKING-PROTECTED BIKE LANE DETAILS



ADDITIONAL DESIGN GUIDANCE

- The recommended minimum width for a parking protected bike lane is 5' plus a 2' buffer, although 7' plus a 3' buffer is preferred to allow for bicycles to pass each other and for passengers to exit vehicles without stepping into the bike lane. This minimum width is acceptable only in constrained conditions.
- Bike markings and directional arrows should be painted, with green backing if possible.
- 6" retroreflective solid striping should demarcate the outside stripe of the protected bicycle lane.
- Use bike lane signage to discourage driving and parking in the bike lane.
- Vertical barriers such as bollards, delineators, or planters should be spaced no further than 15' apart.
- Special consideration must be given to street cleaning and snow removal.
- See sections on bus stops, intersections, and driveways for how to design conflict zones.

3c. Two-Way Protected Bikeways

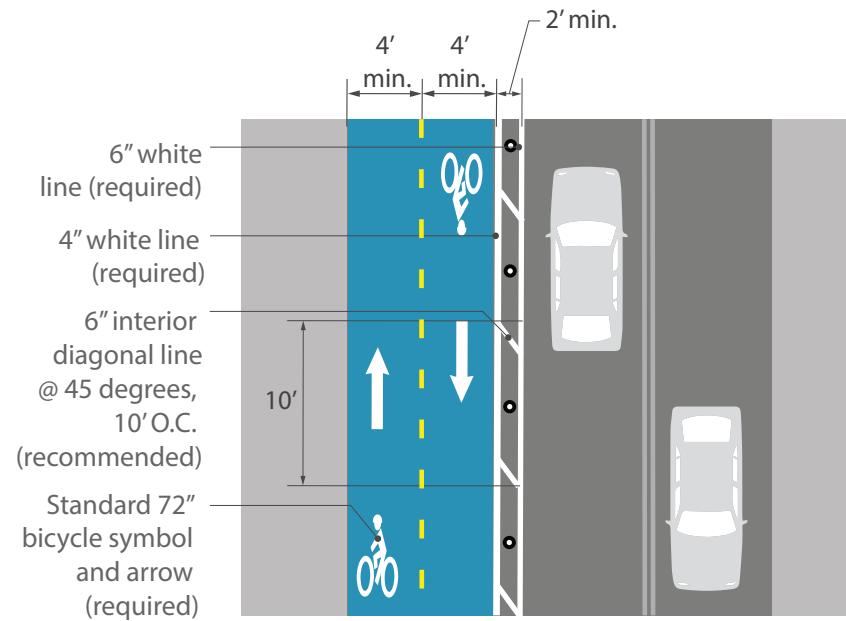
A two-way protected bikeway fully separates cyclists traveling in both directions into a protected space on one side or in the center of the street. This configuration is appropriate for wide, one-way streets where bicycle movement is desired in two directions. It is especially recommended for corridors where there are long stretches between intersecting streets and/or few driveway curb cuts, for example along waterfronts, large parks, cemeteries, highways, or large municipal lots and undeveloped sites. Like other situations where there is bike traffic moving in two directions, possibly against the flow of vehicle traffic, special attention must be paid to providing protection, warning, and visibility at conflict zones.



APPLICATIONS

Two-way protected bike lanes are recommended for bikeways which are major network connections where one side of the street has far fewer building entrances, driveways, and/or intersections than the other, or where there is not enough room for one-way protected bike lanes on both sides of the street. This configuration is common alongside the waterfront, large parks, or restricted rights of way such as highways and railroads. The width and breadth of protected space afforded cyclists in two-way protected bike lanes make them the preferred configuration wherever feasible. They offer the most comfort for novice cyclists and other active mobility modes such as scooters, skateboards, and roller skates, and should be explored on routes which connect recreational destinations such as large parks and open spaces. See JC Bike Master Plan for recommended locations.

TWO-WAY PROTECTED BIKEWAY DETAILS



ADDITIONAL DESIGN GUIDANCE

- Bicycle signals facing cyclists traveling against the flow of vehicle traffic are required at all signalized intersections.
- The recommended minimum width for a two-way parking protected bike lane is 8' plus a 3' buffer; although 10' plus a buffer of 3' is preferred. The recommended minimum width shall only be applied to streets with constrained street widths,
- Bike markings and directional arrows should be painted, with green backing if possible.
- 6" retroreflective solid striping should demarcate the outside stripe of the protected bicycle lane and dashed yellow lines shall mark the center of the bike lane.
- Use bike lane signage to discourage driving and parking in the bike lane.
- Vertical barriers such as bollards, delineators, or planters should be spaced no further than 15' apart.

3d. Raised Bikeways



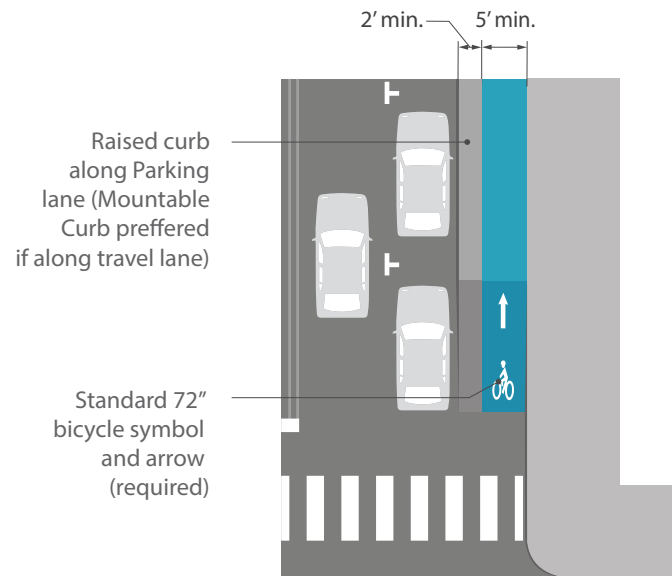
7th Avenue Protected Bike Lane,
Seattle, WA (Street Plans)

Raised bikeways use a curb to separate the bikeway from motor vehicle lanes and a second curb to separate the bikeway from the sidewalk. In essence, this creates a discrete dedicated thoroughfare just for cyclists. This format is prevalent in Copenhagen—one of the great cycling cities in the world—and is becoming more common in North American cities. Raised bikeways also ensure that people cycling are not riding in the gutter of the vehicular roadbed which is often soiled with grease and debris. Raised bikeways may feature one-way or two-way movement, may be at the center or the sides of the street, and the curbs can be squared or “mountable”, meaning that motor vehicles may drive over them if necessary (for example to get around a stalled vehicle, or for emergencies). Raised bikeways can be alongside a travel lane or a parking lane, and may include barrier protection (in addition to the curb) or not. Special consideration needs to be paid to how the grade change is resolved through intersections and across intersecting driveways, bus stops, and pedestrian crossings, and how drainage, street cleaning, and snow removal are managed.

APPLICATIONS

Raised bikeways are the “gold standard” for capitally-reconstructed on-street bike lanes and are the preferred configuration wherever feasible. Priority should be given to bikeways which are major network connections and where there are high vehicle and/or pedestrian volumes such as commercial corridors, where vehicle encroachment in the bike lane is a known issue, or where bike-vehicle conflicts are of particular concern, such as a contra-flow bike lanes. Raised bikeways may include additional protection such as bollards or planters. See JC Bike Master Plan for recommended locations.

TYPICAL RAISED BIKEWAY DETAILS



ADDITIONAL DESIGN GUIDANCE

- The recommended minimum width for a one-way raised bike lane is 5', although 7' is recommended, not including the width of the curb edge.
- Greater bike lane width or use of a buffer is preferred where vehicle parking is allowed alongside the lane. The bike lane should be vertically separated from the roadway by 1"-6" and paved with asphalt (not concrete which has tiresome, repetitive bumps at expansion joints).
- If designing the curb to be mountable by vehicles, it should be 1' wide and have a 4:1 slope edge without any seams or lips which could interfere with bike tires.
- The sidewalk curb should be 1"-5", although 3" or greater is recommended to discourage cyclists from veering onto the sidewalk.
- Drainage should slope to the vehicular roadway.
- Drainage grates should be in adjacent travel or parking lane, not in the bike lane.
- Bike markings and directional arrows should be painted, with green backing if possible.
- 6" retroreflective solid striping should demarcate the outside stripe of the protected bicycle lane.
- Use bike lane signage to discourage driving and parking in the bike lane.
- Vertical barriers such as bollards, delineators, or planters should be spaced no further than 15' apart.
- Special consideration must be given to street cleaning and snow removal.

Sidewalk-Level Raised Bike Lane

A sidewalk level raised bikeway is at the same grade as the sidewalk. The advantage of this configuration is that, in being flush with the level of the sidewalk, it more easily allows pedestrians to access the street without a grade change. This is especially important when considering accessibility to parked vehicles and bus stops for wheelchair users, deliveries, and people with mobility challenges. The disadvantage of this configuration is that it allows cyclists and pedestrians to more easily stray into each other's space, causing potential conflicts.



ADDITIONAL DESIGN GUIDANCE

- Consider using landscaping and street furnishings to separate the bikeway from the pedestrian walkway.
- See guidance for Raised Bikeway.

APPLICATIONS:

Sidewalk-level bikeways should be used wherever a raised bike lane is desired but maintaining level pedestrian access to the roadway is considered a higher priority than containing bicycles to the bike lane. Other than at bus stops and destinations with significant curbside loading needs, these are generally streets with lower pedestrian and bicycle volumes such as in residential areas. Curbside bikeways may transition to and from sidewalk level using ramps periodically wherever a level pedestrian crossing of the bike lane is critical. Sidewalk-level raised bikeways can be designed for one-way or two-way travel, and may be configured as shared-use paths with space for both pedestrians and cyclists such as off-street trails. See JC Bike Master Plan for recommended locations.



Western Avenue Protected bikeway, Cambridge, MA
(Alta Planning + Design)

3e. Off-Street Paths

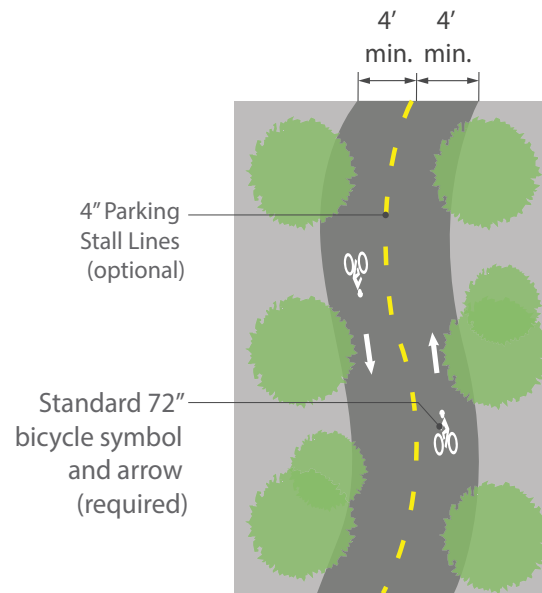
Off street paths and trails are a critical part of an urban bike network because they provide the safest and most pleasurable riding experience for cyclists of all ages and abilities. Off-street paths are physically separated from motorized vehicular traffic by an open space or barrier and are designed to accommodate walking, jogging, and other forms of active mobility and recreation where space allows. Generally located in parks, along waterfronts or highways, and on repurposed rights-of-way such as abandoned rail lines, these bicycle facilities are located outside street network and have virtually no interactions with vehicles except at limited access points and crossings. Off-street paths allow cyclists to continue at a steady pace for long stretches without having to stop for conflicts or traffic lights. As a result, off-street paths with circuitous routes and longer travel distances are often covered in less time than more direct on-street lanes where stopping is far more frequent. In this way, well-located off-street paths can function as the “arterials” of the bike network, connecting and building upon a municipality’s on-street bikeways.



APPLICATIONS:

Off-street paths serve as a complement to, or extension of, on-street networks and are typically located along linear rights-of-way, such as bodies of water, highways, active or inactive rail lines, and large parks or parkways. However, they can also be integrated within the street right-of-way if physical separation is provided between users and vehicular traffic. Off-street paths are often used to connect neighborhoods where the street network is otherwise insufficient.

OFF-STREET PATH DETAILS



ADDITIONAL DESIGN GUIDANCE

- The minimum width for an off-street path is 10', but 14' is preferred, not including curbs or buffer/shy distance from vertical elements such as trees, barriers, and street furniture.
- In general, grades should not exceed 5 percent.
- Markings to indicate the bikeway (or shared-use path) should be painted and separate lanes should be designated with a dashed or solid yellow line in locations with moderate to heavy volumes.
- Wayfinding and/or interpretive signs are optional but further enhance the user experience.
- Off-street paths should be paved with a firm, stable, and slip-resistant material (generally asphalt or concrete) to ensure the safety of a variety of users.
- Where paths are adjacent to roadways, a minimum of three feet should be maintained wherever possible between the edge of the path and the curb.

4. BIKEWAYS + BUS STOPS



Floating bus stop, San Francisco, CA
(Tim Papandrea)

Jersey City has an extensive bus system, with more than 50 different routes operated by NJ Transit alone. For Jersey City residents, buses are a vital mobility option that compliments the bike system in supporting the 75% of households who are car-free or “car-light” (defined as households with one car). However, the interaction between buses and people cycling on the street requires careful consideration because buses and their passengers often have to cross bikeways to access curbside stops. In some cases, bikeways may also bisect sidewalks and bus boarding areas, which creates an inherent conflict.

Bus stops are generally located along the curbs of sidewalks, so where there are curbside bike lanes, there is an inherent conflict between bicycles and buses which enter and exit bus stop areas. Buses are large vehicles which have sizeable blind spots, make wide turns, and can present a significant visual obstruction between cyclists, pedestrians, and other vehicles. For all these reasons, where bike facilities and bus stops intersect, there needs to be extra emphasis on organizing paths of travel, making transitions gradual, calling attention to conflicts, ensuring accessibility, and maintaining sightlines and visibility between modes.



West 1st Street, Los Angeles, CA
(City of Los Angeles)

4a. Bus Boarding Island w/ Bike Lane

Bus boarding islands present opportunities to place bike lanes between the bus island and the sidewalk, preventing conflicts between buses and cyclists and creating more space for people waiting, boarding, and alighting. Bus boarding islands also reduce bus dwell time. This configuration also ensures people cycling do not have to mix with motor vehicles at the bus stop and, when placed near intersections, the boarding islands can improve pedestrian safety by reducing exposure to traffic and crossing distances at intersections. Boarding islands are also better for bus operations because the bus stop is in a moving lane of traffic which prevents other vehicles from parking or standing in the bus stop. These islands can be designed with a ramp so that the bicycle lane is elevated to the grade of the sidewalk/bus island grade or with two opposing pedestrian ramps to create an ADA-compliant crossing of the bike lane channel (see Sidewalk Level Raised Bikeway, page 40).



Dexter Avenue, Seattle, WA
(Green Lane Project)

APPLICATIONS:

Bus boarding islands are recommended for all bus stops at curbside bike lanes where roadway width and traffic volumes allow. Priority should be given to locations with the highest bus boarding activity, most frequent bus stopping, highest volumes of cyclists, or where documented safety and accessibility issues have occurred.

BASIC COMPONENTS



Required

- Standard MUTCD bikeway pavement markings (bike lane marking, arrow etc.)
- Boarding islands must be designed to a height that facilitates accessible bus boarding based on the lowest platform height of stopping buses
- The island must be ADA-compliant for boarding maneuvers by wheelchair passengers, including adequate island width and ramping for access points with grade changes
- Bicycle yield markings and signage must be installed wherever a pedestrian crossing intersects the bike lane
- Detectable warning strips must be placed on both sides of every pedestrian crossing over the bike lane
- If the island is located at the start of a street segment or is not within a parking lane, install reflective vertical elements and/or signage at the leading corner
- Drainage should be directed to the roadway catch basins

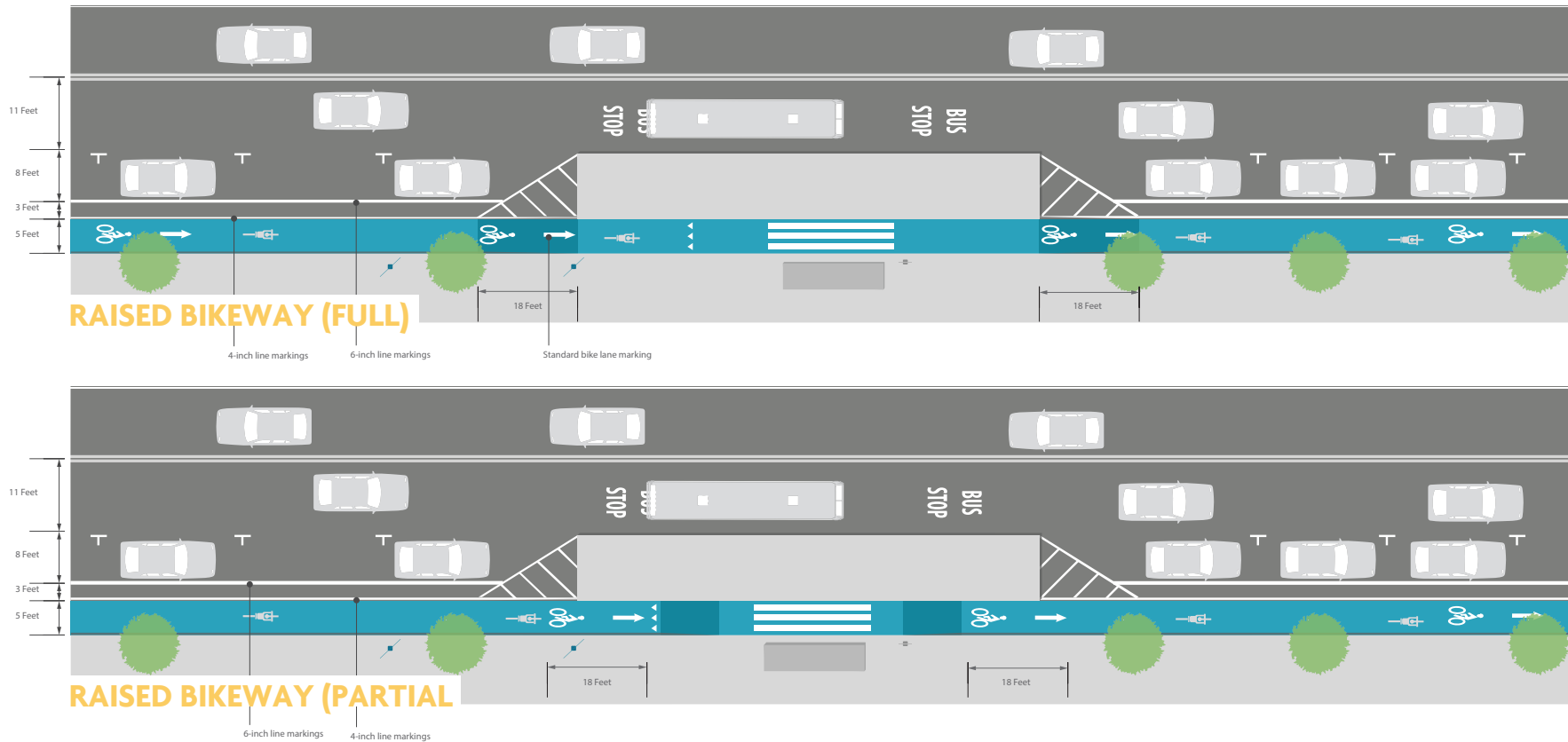
Recommended

- Green painted bike lane wherever conflict zones exist
- High-visibility continental crosswalk markings where pedestrians cross the bike lane
- If at an intersection, an accessible ramp should be placed at the crosswalk end of the island
- For mid-block stops, ramp up the bike lane to a raised crosswalk across the bike channel
- Bus shelters onboarding islands should be located at least 10 feet from crosswalks over the bike lane

Optional

- Bicycle lane yield line markings (“shark’s teeth”) at the pedestrian crossing
- Standard MUTCD bikeway pavement marking with a ponytail or other creative additions that do not reduce legibility
- Leaning rails along the edge of the island
- Consider additional amenities such as artwork, seating, and plantings
- Lower cost rubber bus islands may be used for pilot or interim “quick build” projects

DESIGN DIMENSIONS



Required

- 8' minimum island width, or 9' if including leaning rails
- Island length must be as long as the span between the front and rear doors of stopping buses
- 5' minimum bike lane width, 6' or greater desired, especially where lanes are intended to accommodate higher volumes of people using scooters, skateboards, etc.)
- 8' min. width for two-way on-street protected bike lanes (not including 1' buffer minimum where on-street parking isn't present; 2' where it is)
- Pedestrian access ramp maximum slope of 1:12
- See page 8 for all required striping and marking dimensions

Recommended

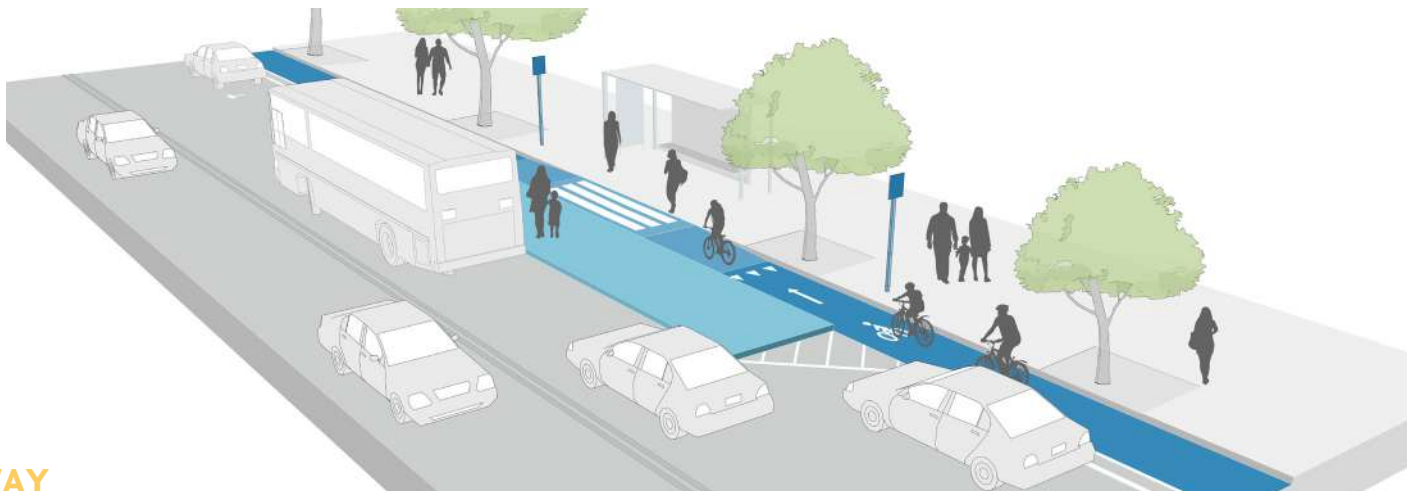
- Bicycle ramps should not exceed a 1:8 slope

Optional

- Striped buffer between bike lane and bus island



RAISED BIKEWAY



SLOPED BIKEWAY

ADDITIONAL DESIGN GUIDANCE

- Boarding islands should be large enough to allow groups of passengers to wait, based on observed usage patterns of the existing bus stop(s).
- Boarding islands should include shelters, seating, wayfinding, placemaking enhancements, and passenger information when feasible.
- Boarding islands can be extended to include bike parking, additional seating, parklets, or other functional / placemaking amenities.
- Leaning rails can be used to channel pedestrian crossings to limited, marked locations in cases where there are high pedestrian and/or bicycle volumes.
- See NACTO's Transit Street Design Guide for more detailed design guidance.

4b. Through Bike Lane at Bus Stop

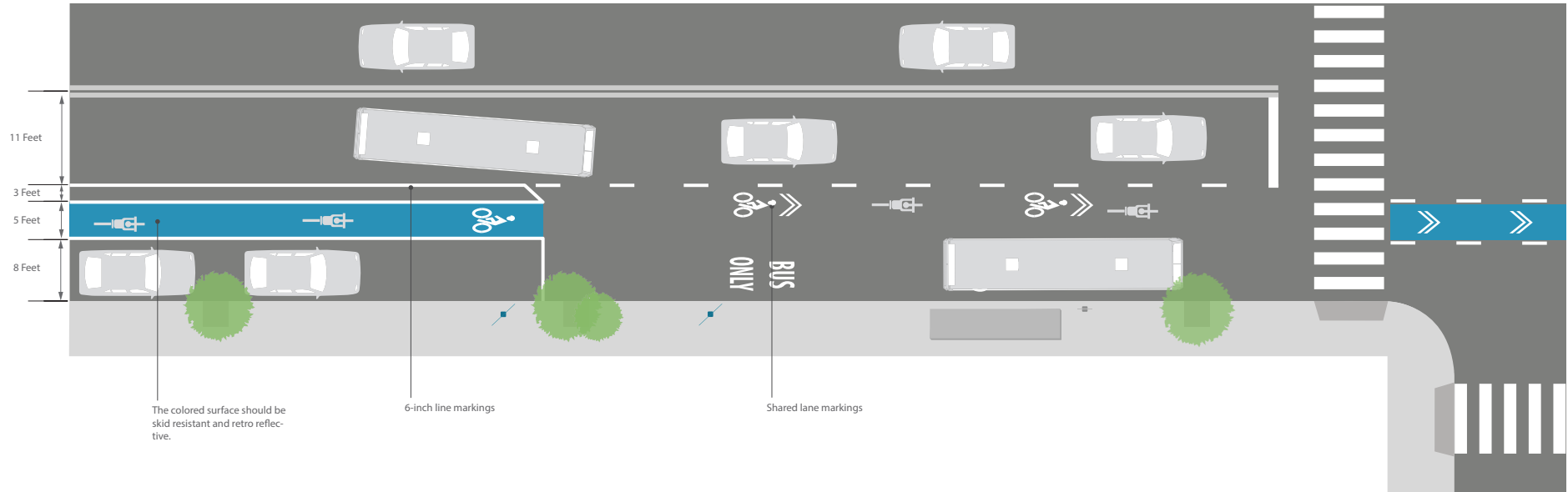
Through bike lanes direct cyclists around / adjacent to the bus layover area of the bus stop. This involves installing a high-visibility crossing zone in advance of the bus stop, with cyclists given the right-of-way so that cyclists are neither forced to wait behind stopped buses nor do they need to enter a mixed lane of traffic. Instead, cyclists have a dedicated facility with clear sightlines for safely negotiating the bus stop zone.



APPLICATIONS:

Through bike lanes are recommended at curbside bus stops where there are curbside bike lanes but where floating bus islands are not feasible. Examples: Montgomery Street, Columbus Drive.

BASIC COMPONENTS



Required

- Bus-bikeway designs should be in accordance with NJ Transit standards
- The interaction of buses and bike lanes shall be minimized at bus stops
- Standard MUTCD bikeway pavement marking
- Retroreflective striping demarcating the inside and outside stripe of the bicycle lane
- Crossbike markings (see page 11) in merge area

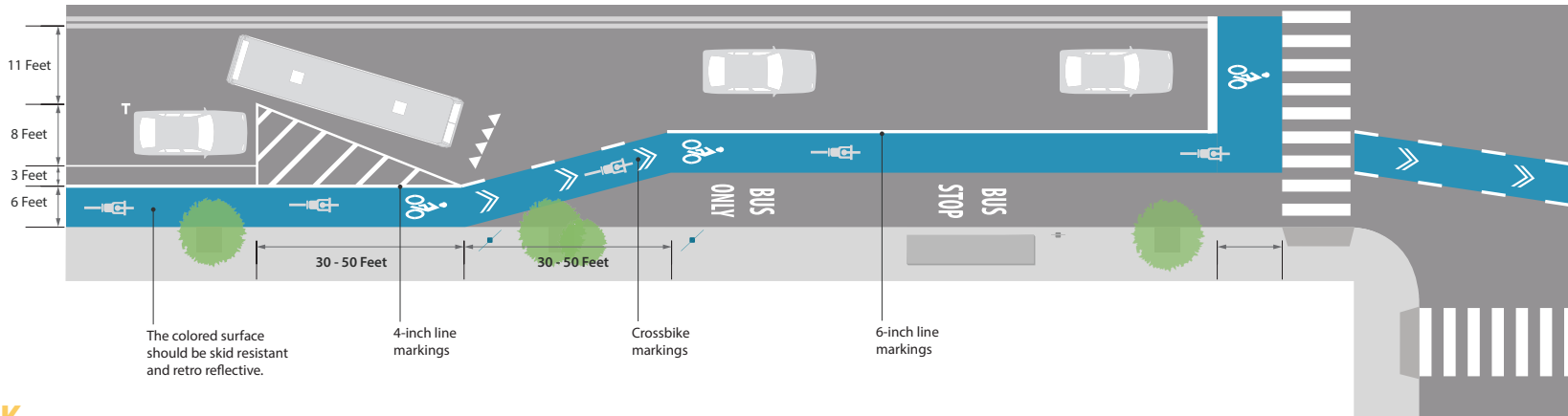
Recommended

- Double white stripes demarcating the outside edges of the bike lane
- Bike box at signalized intersections where intersecting bikeways exist or are planned. (see page 90)
- Stop bar at controlled intersections
- Green retroreflective paint for conflict zones.
- Yield line markings for buses where they must cross over the bike lane
- "BUS AHEAD" sign in bike lane prior to merge area

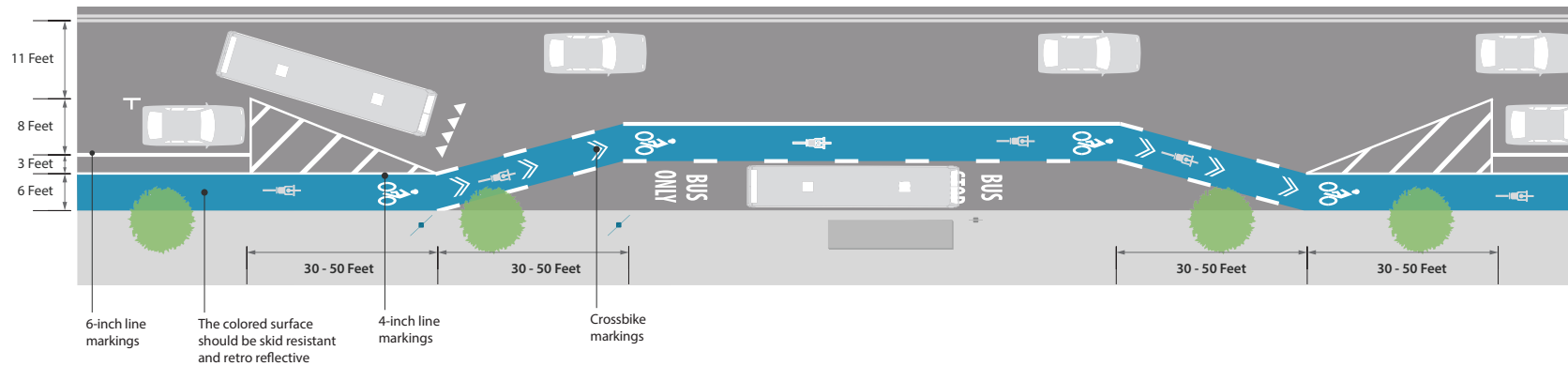
Optional

- Vertical barrier elements (e.g. planters and/or delineators) may be placed between the outside of bike lane and the adjacent vehicular travel lane
- Directional turn arrows
- Right-turn pocket / queuing area
- Standard MUTCD bikeway pavement marking with ponytail or other creative additions that do not reduce legibility

INTERSECTION



MID-BLOCK



Required

- Bus-bikeway designs should be in accordance with NJ Transit standards
- The interaction of buses and bike lanes shall be minimized at bus stops
- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)
- Bus lane must be wide enough so buses do not impede bike lane (minimum 9')
- See page 8 for all required striping and marking dimensions
- See page 11 for bike box dimensions
- Pedestrian access ramp maximum slope of 1:12

Recommended

- Minimum 30' ingress / egress taper at bus-bikeway merge area
- 1' stop bar across vehicular travel lane

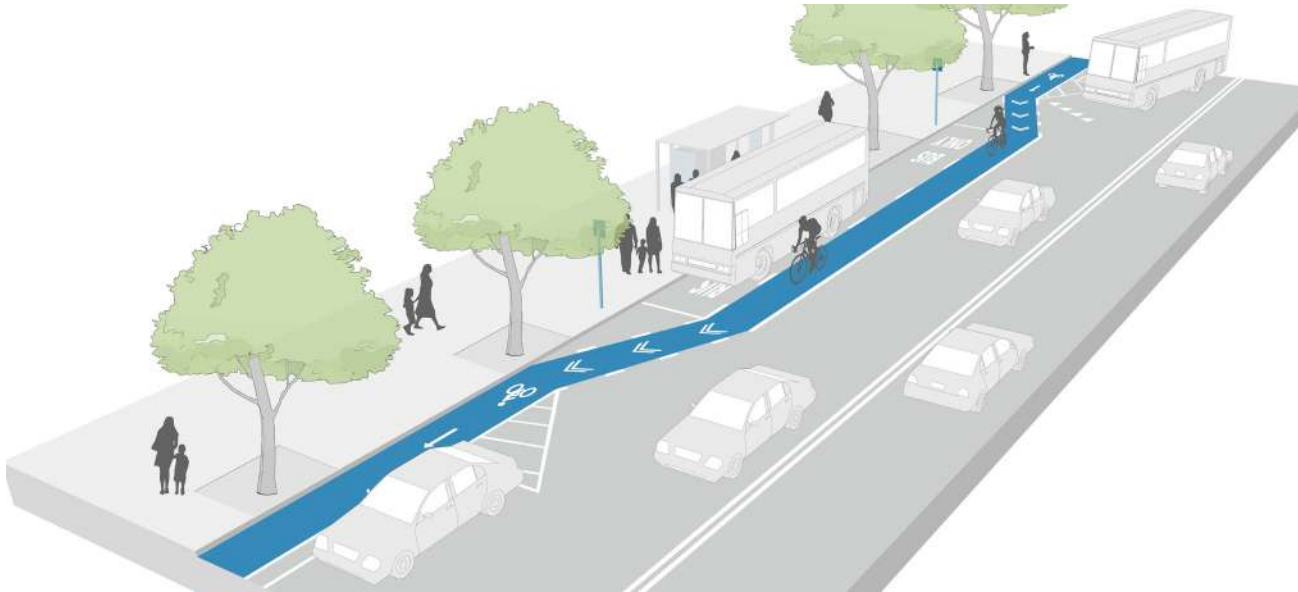
Optional

- 2' minimum buffer width (if applicable)

INTERSECTION



MID-BLOCK



ADDITIONAL DESIGN GUIDANCE

- Bus boarding area should be 10 feet clear from the crosswalk at intersections.
- If using a concrete bus pad, locate concrete seams on either side of bike lane.
- Consider leading bicycle / pedestrian signal interval at all signalized intersections.
- See NACTO's Bikeway Design Guide and Transit Street Design Guide for more detailed design guidance.

4c. Shared Bike Lane/Bus Stop

A shared bike lane bus stop is a configuration where a curbside bike lane is ramped up to sidewalk grade at the bus stop. Bus passengers board and alight in the bike lane, where cyclists are required to yield. When no bus is present, passengers wait on the sidewalk and cyclists may ride through.



Sherbourne Street, Toronto, ON
(Flickr User MMA | MHA)

APPLICATIONS:

Shared bike lane bus stops are only recommended for locations where sidewalk and street width is severely constrained such that bicycles cannot be given dedicated roadway space to maneuver around buses, and a floating island cannot be installed with enough width to allow for wheelchair bus boarding and alighting maneuvers. This is a “last resort” retrofit design to accommodate both bus stops and bikeways on very narrow streets but is not advised where there are short bus headways, large volumes of bus passengers, or large volumes of cyclists.

BASIC COMPONENTS



Required

- Standard MUTCD bikeway pavement markings (bike lane marking, arrow etc.)
- Bicycle lane yield line markings (“shark’s teeth”) at pedestrian crossing
- Detectable warning strips must be placed between the sidewalk and the bike lane bus boarding area
- Drainage should be directed to the roadway catch basins

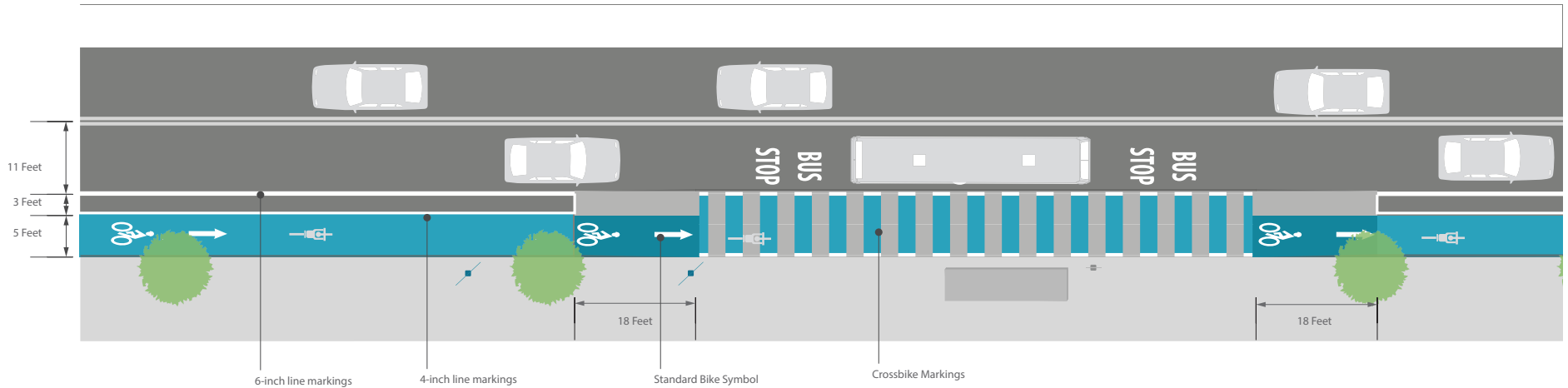
Recommended

- Green painted bike lane wherever conflict zones exist
- High-visibility continental crosswalk markings where pedestrians cross the bike lane
- If at an intersection, an accessible ramp should be placed at the crosswalk end of the island

Optional

- Bikeway pavement marking with ponytail or other creative additions that do not reduce legibility
- Lower cost rubber bus islands may be used for pilot or interim “quick build” projects

DESIGN DIMENSIONS



ADDITIONAL DESIGN GUIDANCE

- Measures must be taken to ensure bicyclists yield to boarding and alighting transit passengers; compliance is critical to providing safe and comfortable conditions all users.
- See NACTO's Transit Street Design Guide for more detailed design guidance.

Required

- 6' minimum raised bike lane bus stop width
- Raised area must be as long as the span between the front and rear doors of stopping buses
- Pedestrian access ramp maximum slope of 1:12
- See page 8 for all required striping and marking dimensions

Recommended

- Bicycle ramps should not exceed a 1:8 slope.
- Bus shelters should be set back 3 feet from the bike lane and/or open to the building side of the street.
- Terminate the boarding platform at least 10 feet from the crosswalk to allow bicyclists to queue in front of transit vehicles.

Optional

- Striped buffer between bike lane and curbs



NEIGHBORHOOD GREENWAYS

1. TRAFFIC CALMING ELEMENTS	60
2. PROGRAMMING	84

Seen extensively in bike-friendly cities like Portland and Seattle, Neighborhood Greenways integrate a suite of traffic-calming and green infrastructure elements into residential areas.

The result is the creation of safer, quieter, more pleasant streets for everyone, including those walking and cycling who may choose these more gentle routes to busier arterial thoroughfares. Also referred to as “bicycle boulevards,” the use of intentional and site-specific traffic calming interventions allow cyclists share the street with motor vehicles, as they induce lower vehicle volumes and target speeds not to exceed 20mph. Automobile traffic is heavily de-emphasized through the design elements on these corridors, whereas trees, plantings, bicycle and pedestrian amenities, and community facilities are prioritized. When deployed in a widespread and well-connected fashion, neighborhood greenways make up a network of their own - one where you are likely to find adults and children riding bikes or using streets for games and other social or physical activities.

Neighborhood greenways are recommended for streets with no more than two lanes of travel through quieter residential neighborhoods, connect to recreational areas and community destinations, and/or link to major bike routes with more robust facilities. In Jersey City, they are especially useful for lower-volume crosstown streets where more than a narrow bike lane is desired but is prevented by street width constraints. Given the incorporation of traffic-calming and greening features, neighborhood greenways can be beneficial for any residential corridors where there are concerns related to traffic speed, traffic crashes, or a lack of greenery or active recreation opportunities. See JC Bike Master Plan for recommended locations.



BASIC COMPONENTS

Required

- Signage designating the route as a neighborhood greenway
- Bikeway markings reinforcing the direction of travel and neighborhood greenway status

Recommended

- Speed limit reduction to a maximum of 20mph, with corresponding signage
- Traffic calming elements as needed to reduce daily traffic volumes to <2,000 vehicles, preferably <1,000 ADT
- Green-backed super sharrows (see page 24)
- Conventional, buffered, contra-flow, advisory, or protected bikeway segments as contextually appropriate
- Intersection gateway / daylighting treatments that narrow the vehicle travel lane and provide greenery or amenities
- Traffic-calming elements with green infrastructure and/or amenities every 200-300 feet along the corridor
- Bike box (see page 11)
- Crossbike markings (see page 88)
- Stop bar at controlled intersections

Optional

- Surface treatments / murals may be incorporated into some project elements
- Programmable public space, with amenities such as tables, chairs, play/fitness equipment, games, shade, etc.
- Directional turn arrows
- Yield Line markings at pedestrian crossings
- Left or right-turn pocket / queuing area

1. TRAFFIC CALMING ELEMENTS

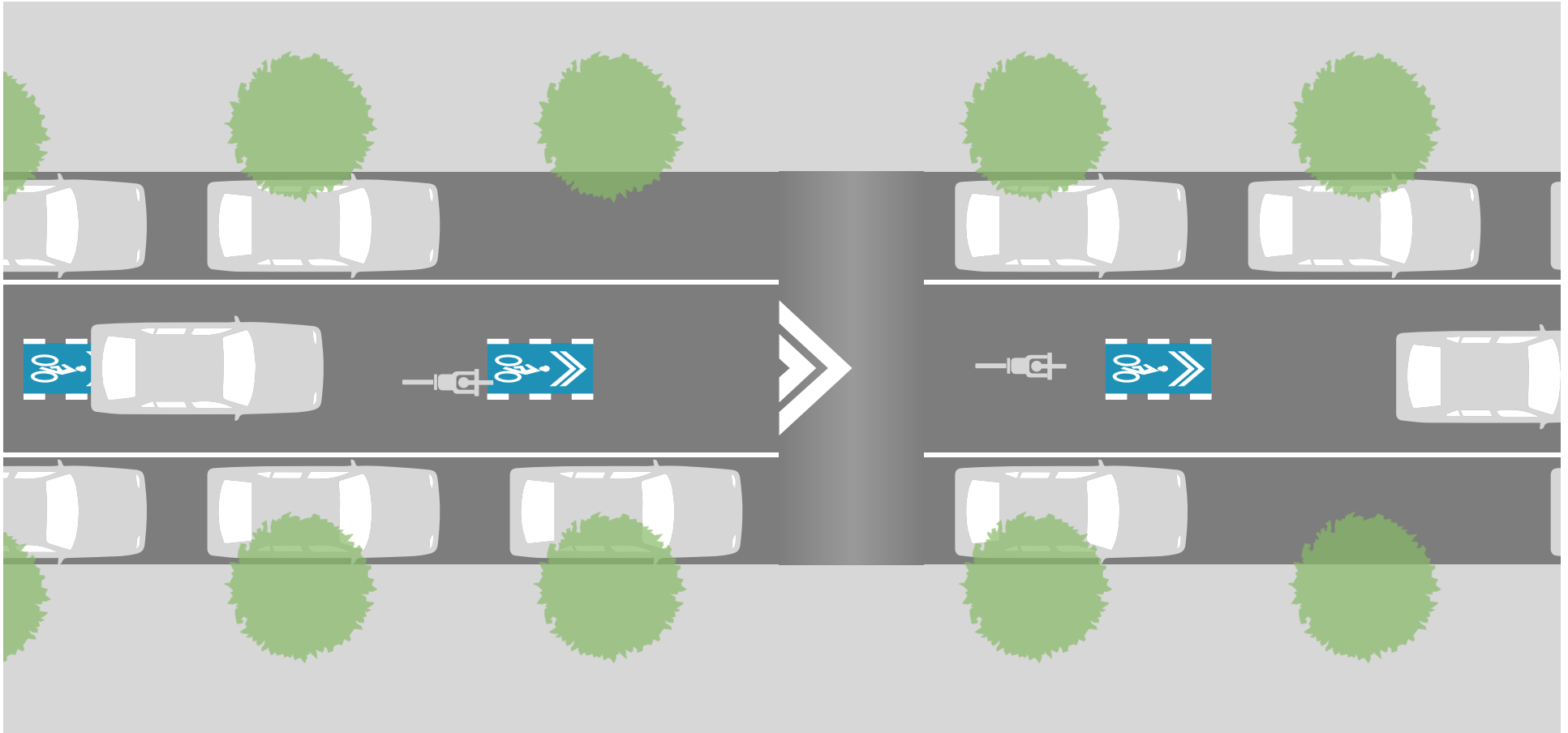
1a. Speed Hump

Speed humps are paved or rubberized mounds installed in the roadway which cause drivers to slow down. Speed humps can be divided into multiple sections with spacing to match large vehicle wheelbases. In this configuration, they are generally referred to as “speed cushions” where the intent is that bicycles and vehicles with wider wheel bases such as buses and fire trucks can reach their destinations expediently without being interrupted by the humps.



SE Clinton Street, Portland, OR
(J. Maus/Bike Portland)

BASIC COMPONENTS

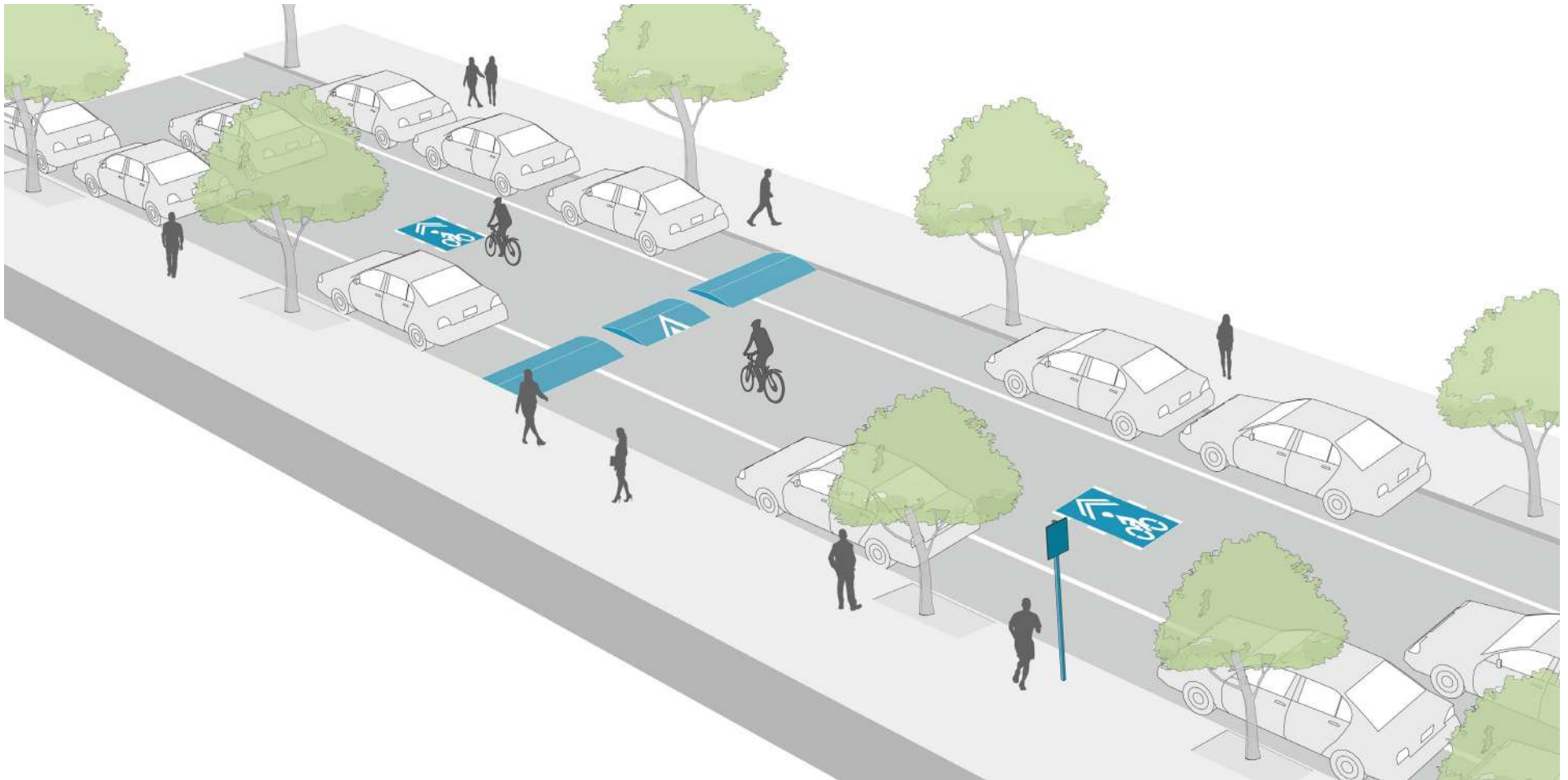


- 1 Asphalt speed hump or vulcanized rubber speed cushion
- 2 12" retroreflective white triangular pavement markings
- 3 BUMP pavement marking

DESIGN NOTES

- Speed humps may be applied on 1-way or 2-way streets.
- Vertical speed control elements (like speed humps) shall be accompanied by a sign warning drivers of the upcoming device.
- Vulcanized rubber speed hump units may be removed for road resurfacing, snow plows, or to test the product at various locations.

ADDITIONAL DESIGN GUIDANCE



- The spacing for and height of speed humps / cushions should be determined based on the target speed of the roadway
- Speed humps should be spaced no more than 200 ft. apart and with a height of 3" - 4" to achieve a target vehicle speed of 15 - 20 mph
- Speed humps / cushions should not be placed in front of driveways or curb cuts
- Where used on bus routes, major emergency access routes and / or commercial corridors, speed cushions designed to accommodate the wheel-base of such vehicles should be selected over speed humps
- Speed hump slopes should not exceed 1:10 or be less steep than 1:25. Side slopes on tapers should be no greater than 1:6. The lip edge should be no more than ¼-inch high
- Where curbside bicycle lanes exist, taper the speed hump width to allow a 2.5' clear 'cycling slot' smooth bicycle passage, which may also facilitate better stormwater drainage



DO NOT
ENTER

EMERGENCY VEHICLES
AND BICYCLES EXCEPTED
\$75 MINIMUM FINE

NO
LEFT
TURN

NO
U-TURN

1b. Pinch Point

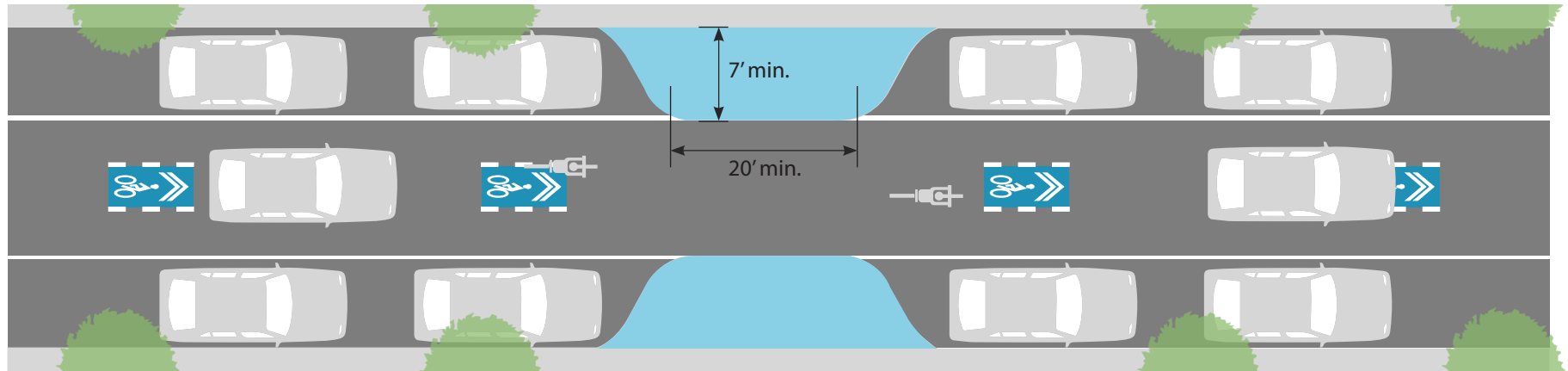
Pinch Points are mid-block curb extensions that may be applied to both sides of one- or two-way streets. Pinch points may include marked crosswalks and are sometimes called “neckdowns” or “chokers”. Pinch points help slow traffic speeds by forcing a yield condition between opposing directions of vehicular travel, or by narrowing the travel-way along a one-way street. They also provide opportunities for placemaking enhancements such as public art, seating, bike parking, plantings and other green infrastructure treatments (when built out with permanent materials).



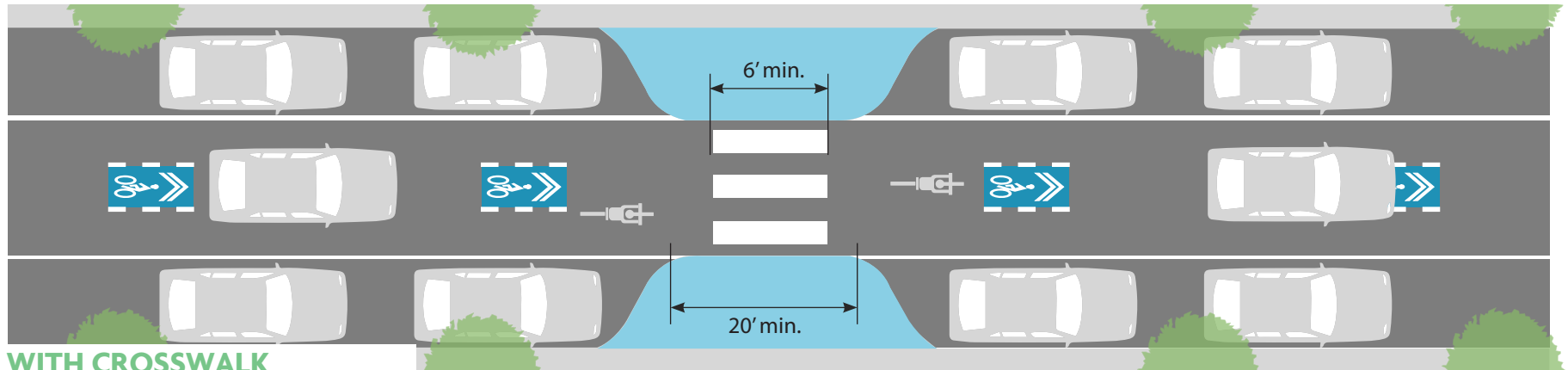
APPLICATIONS:

Pinch points are appropriate for one-way or two-way, low-volume residential streets such as Neighborhood Greenways. They can be used as a gateway treatment at the start or end of a block, or as a mid-block treatment closer to the midpoint. In combination with a striped crosswalk, pinch points are a useful treatment which can provide a mid-block crossing opportunity for long blocks (400'+) or where there may be mid-block destinations which warrant a nearby crossing such as a park, school, church, or apartment building.

BASIC COMPONENTS



WITHOUT CROSSWALK



WITH CROSSWALK

Required

- Curb extensions can be built at sidewalk grade with concrete or asphalt and curbing, or flush with the roadway using striping and temporary materials
- Curb extensions must be ADA-compliant including detectable warning strips at pedestrian crossings
- Mountable vertical barrier elements such as curbs, parking stops, armadillos, ceramic markers, or delineator posts shall be used to ensure motor vehicles do not encroach into the pinch point area
- Reflective vertical elements and/or signage at the leading corner
- Drainage should be directed to the roadway catch basins

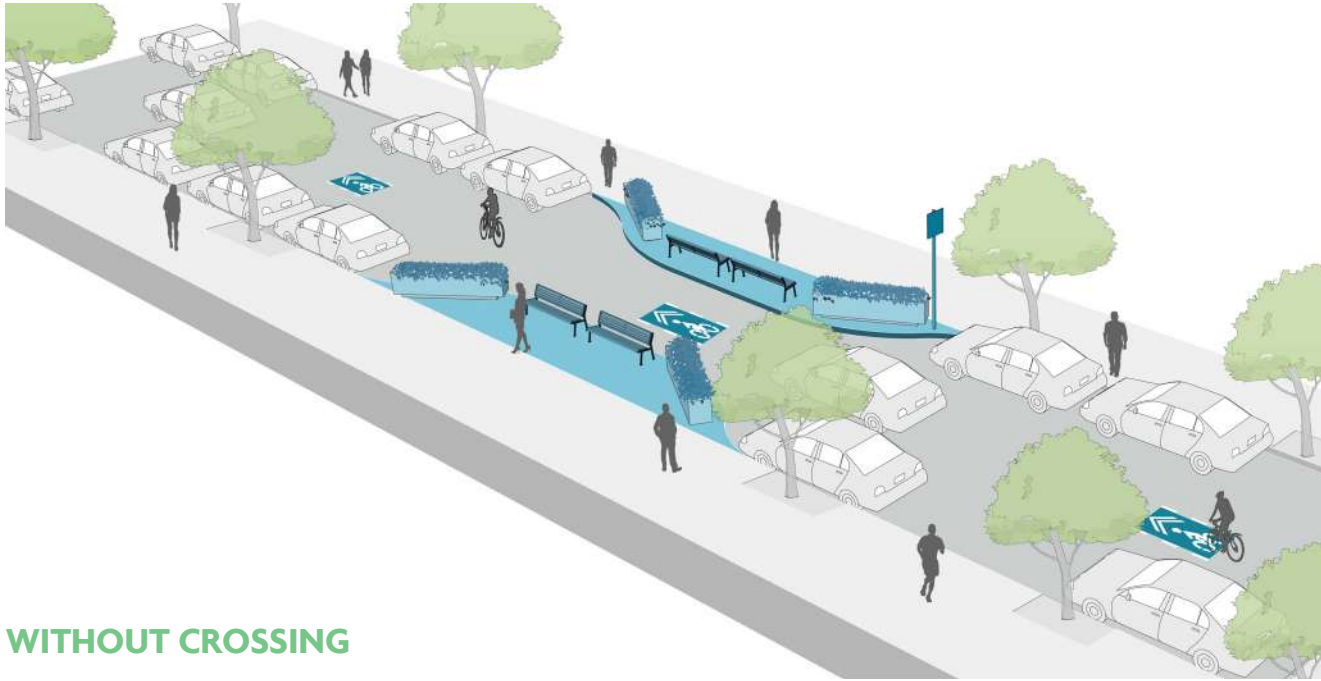
Recommended

- A 4" retroreflective double white stripe should demarcate the pinch point area in lieu of curbing
- A surface treatment should be used to visibly distinguish the pinch point if at roadway grade
- Benches, plantings, bike racks, greening, and other amenities

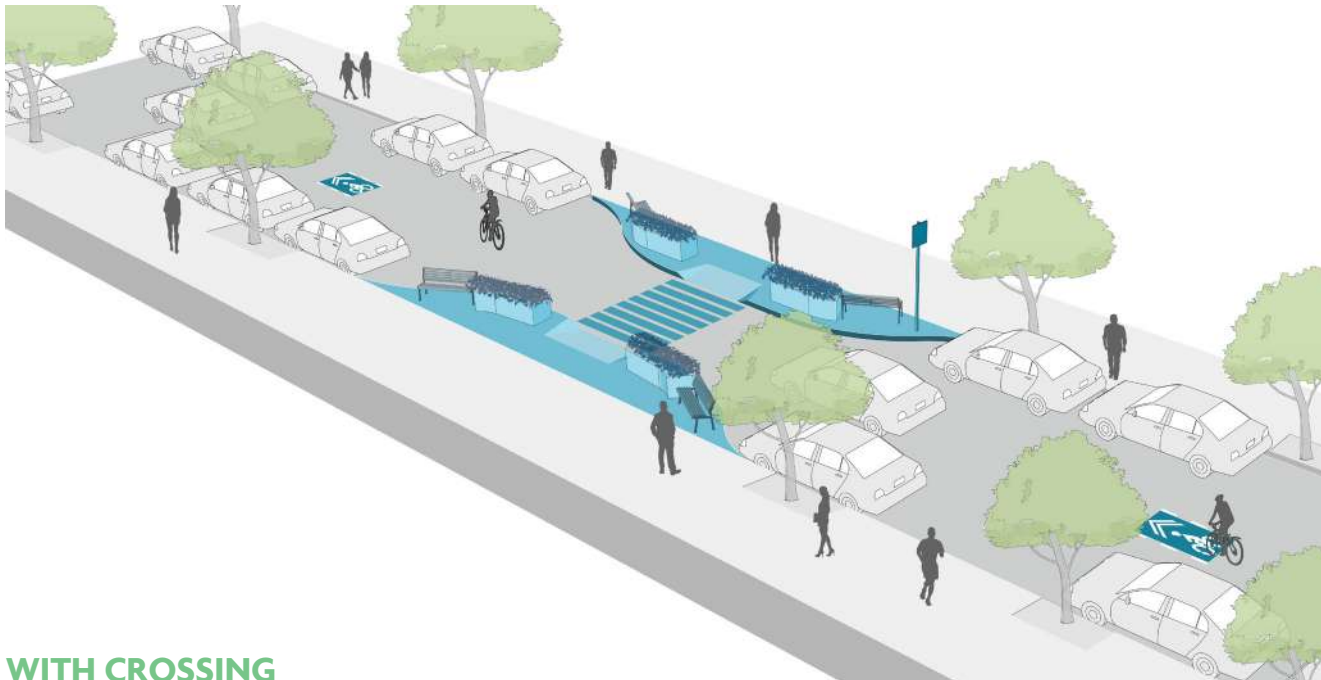
Optional

- Crosswalks may be included at mid-block locations (with requisite signage and markings), especially for blocks greater than 400' in length and/or at known pedestrian desire lines
- Stop control with requisite signage and markings
- Yield markings may be used to reinforce the desired vehicular movement
- Circular or rectangular planters may be used for beautification and to further prevent vehicular encroachment
- Murals may be used for beautification and to increase the visibility of interim design pinch points

DESIGN DIMENSIONS



WITHOUT CROSSING



WITH CROSSING

Required

- The 'choke zone' length shall be a minimum of 20'
- The width of the pedestrian area of the choke point will vary based on street design/configuration but shall be a minimum of 6' wide where parallel on-street parking is present
- If used, yield lines shall be located at least 10' from the beginning of the choke point
- Travel lanes shall maintain a minimum 9' clear width between mountable vertical barriers to enable emergency vehicle access
- A 14' clear width between non-mountable vertical barriers shall be maintained for emergency vehicle access / operation

Recommended

- N/A

Optional

- N/A



Mid-block pinch point with rain garden,
Location unknown (Unknown)

ADDITIONAL DESIGN GUIDANCE

- Pinch point width is typically one foot less than the width of the parking lane, but the curb extension can also extend to the curbside edge of the bicycle lane when one is striped.
- Placement of pinch points should not impede access to/from existing bicycle lane or bus stops, or driveways unless part of an access management plan.
- Except for intersection approaches, consider removing the centerline from two-way streets with pinch points.
- In select locations, the area defined by a pinch-point may be used for other streetscape amenities, such as bicycle parking / amenities, trash receptacles, benches, bus stops, etc. but must not impede pedestrian flow, obstruct clear path emergency vehicle operations, or limit sight lines.
- Pinch point curb extensions must maintain stormwater flow / drainage.
- Vertical barrier elements should be used to alert drivers and the snow plow operators to presence of the pinch point area.
- Pinch points may be designed in conjunction with the placement of a fire hydrant, however the length of the curb extension should be equal to / greater than the 'no parking' zone (typically 15 feet in either direction) and access to the hydrant must not be impeded by any non-mountable vertical barrier elements.

1c. Chicane

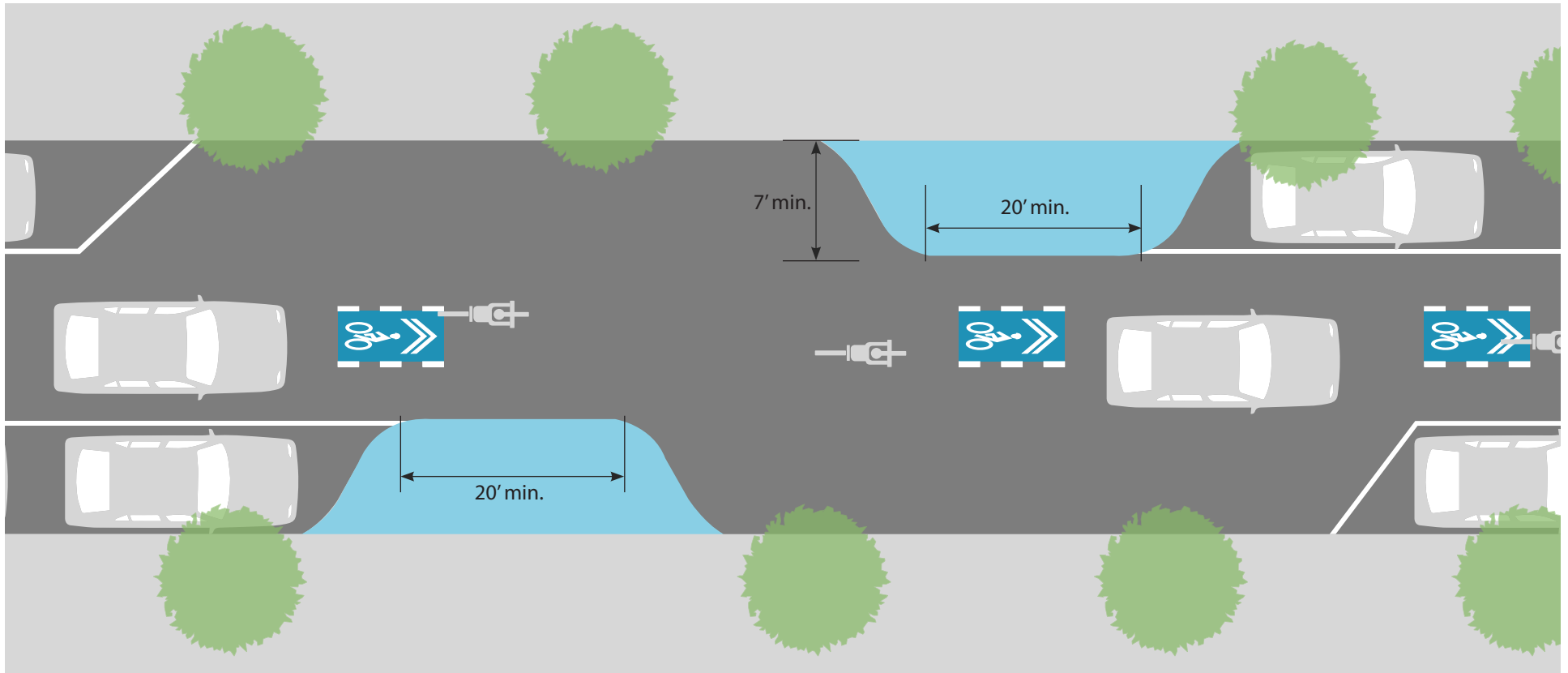
Chicanes are offset curb lines that introduce lateral shifts to travel lanes, creating a 'slalom effect' to reduce vehicular speeds. Chicanes can also provide an opportunity to introduce public art or other street enhancements, like planters and on-street bicycle parking. Low-cost chicanes may be created along narrow streets with only one parking lane by periodically alternating the location of the parking on opposite sides of the street.



APPLICATIONS:

Chicanes are appropriate for low volume residential streets such as Neighborhood Greenways. They are located mid-block and can be configured for one-way or two-way streets. Unlike pinch points, chicanes provide horizontal deflection, forcing drivers to make small turns which causes them to slow down. Therefore, like speed humps, they are a good treatment for streets with documented speeding issues, but with the advantages of creating public space for amenities and without causing vehicles to bounce.

BASIC COMPONENTS



Required

- Curb extensions can be built at sidewalk grade with concrete or asphalt and curbing, or flush with the roadway using striping and temporary materials
- A 4" retroreflective double white stripe should demarcate the pinch point area in lieu of curbing
- Curb extensions must ADA-compliant including detectable warning strips at pedestrian crossings
- Mountable vertical barrier elements such as curbs, parking stops, armadillos, ceramic markers, or delineator posts shall be used to ensure motor vehicles do not encroach into the pinch point area
- Reflective vertical elements and/or signage at the leading corner
- Drainage should be directed to the roadway catch basins

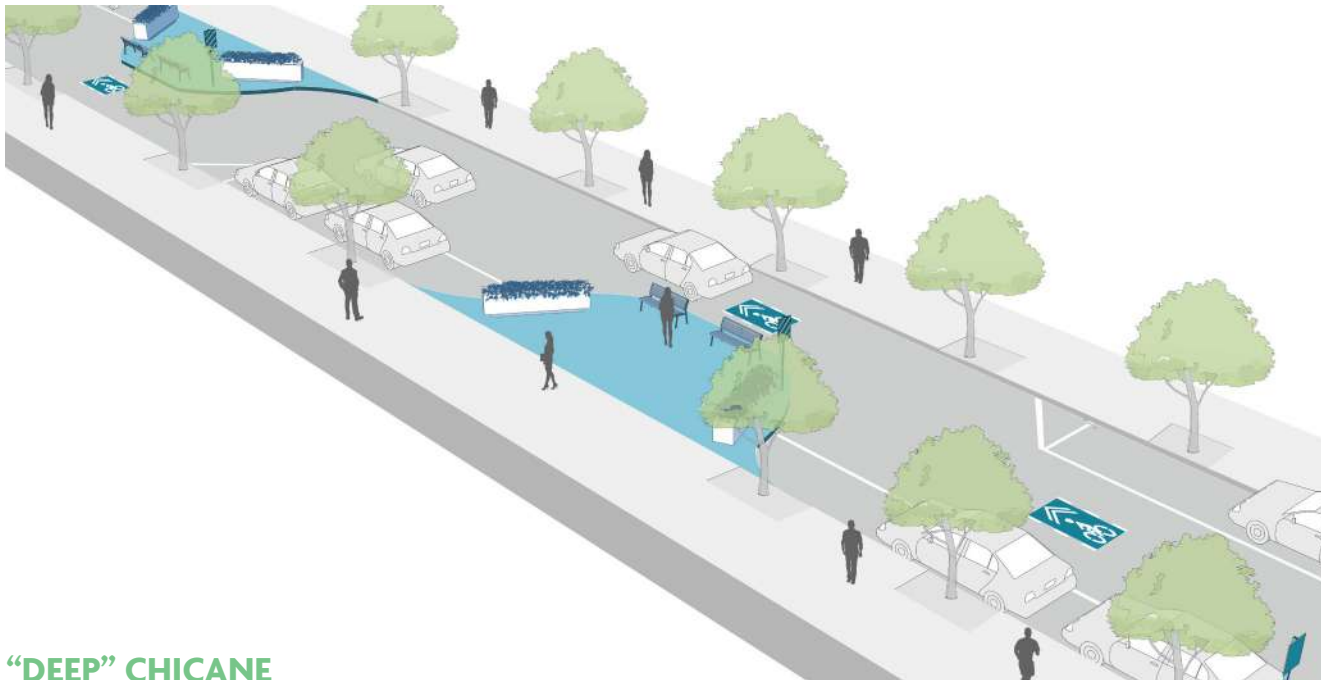
Recommended

- A surface treatment should be used to visibly distinguish the pinch point if at roadway grade
- Parking stops and other vertical barrier elements (ceramic markers delineator posts, armadillos, etc.) may be placed between the parking lane and the chicane, as well as along the taper to discourage vehicular encroachment
- Benches, plantings, bike racks, greening, and other amenities

Optional

- Crosswalks may be included at mid-block locations (with requisite signage and markings), especially for blocks greater than 400' in length and/or at known pedestrian desire lines
- Yield markings may be used to reinforce the desired vehicular movement
- Circular or rectangular planters may be used for beautification and to further prevent vehicular encroachment
- Murals may be used for beautification and to increase the visibility of interim design pinch points

DESIGN DIMENSIONS



“DEEP” CHICANE

Required

- The minimum chicane ingress length should be 15'
- The minimum chicane egress length should be 5'
- Minimum chicane width is one foot less than parking lane width if there is parking on both sides of the street

Recommended

- Chicanes should utilize a 45° angle (or shallower), as measured from the curb to allow safe lane shift, facilitate snow plowing operations, and to maximize available on-street parking
- A minimum 1' buffer should be provided between the outside edge of the chicane and the outside edge of the parking lane. Where used, shared use lane markings shall be centered between chicane locations

Optional

- N/A



Chicane, Edmonton, AB
(Dale Calkins)

ADDITIONAL DESIGN GUIDANCE

- Parking chicanes should be placed on alternate sides of the street approximately every 100' as driveways and intersections allow.
- Placement of chicanes should not impede access to / from existing driveways unless part of an access management plan.
- Except for intersection approaches, consider removing centerline from two-way streets with chicanes.
- Minimum chicane spacing / taper varies; to be determined by target speed and existing street geometry (see MUTCD for more guidance)
- Chicanes must maintain stormwater flow / drainage.
- Vertical barrier elements should be used to alert drivers and snow plow operators to the presence of the chicane area, or removed for winter.

1d. Median Refuge Island Diverter

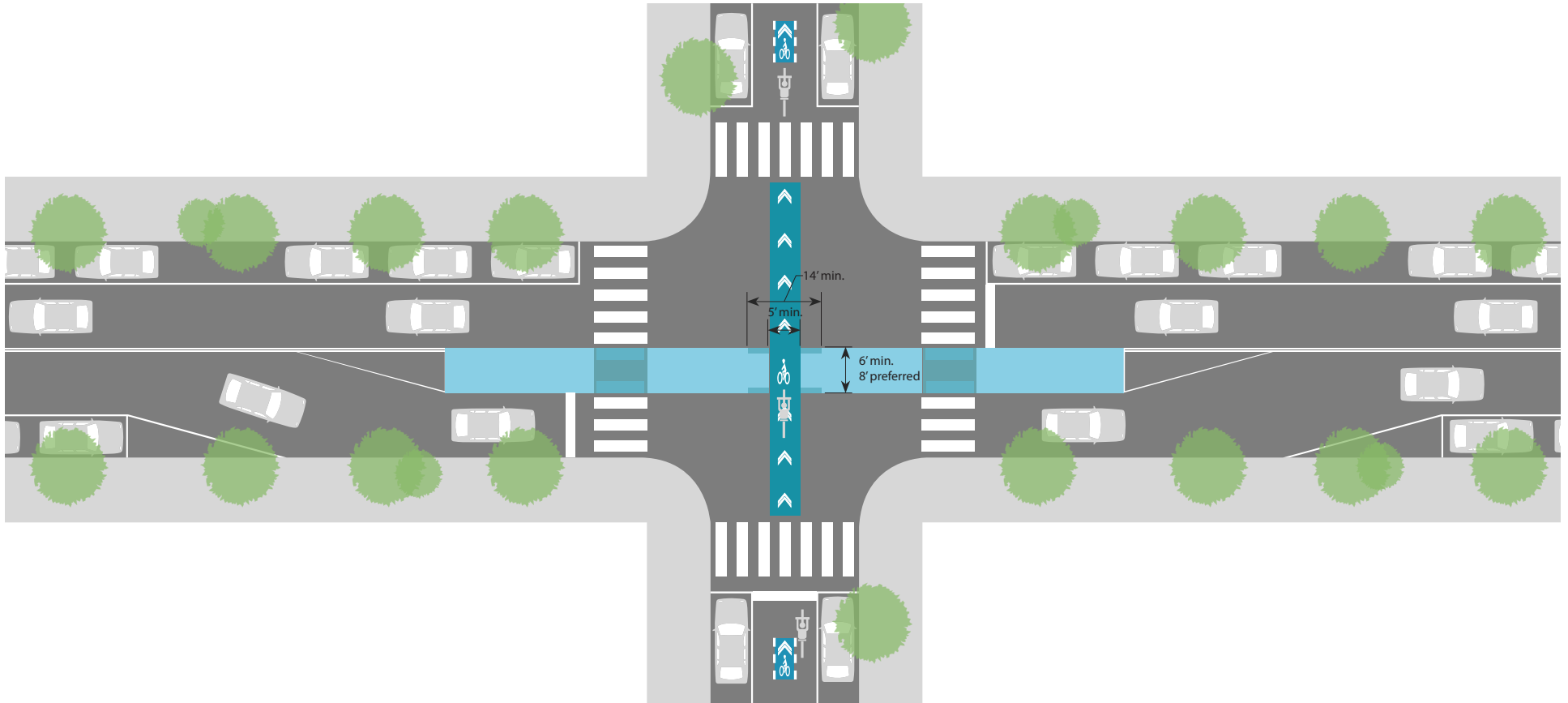
Bicycle refuge islands provide protected mid-intersection crossing areas in which cyclists (and in many instances pedestrians) can safely wait at the mid-point of a two-stage street crossing. Bicycle refuge islands decrease the crossing distance and reduce physical exposure to vehicular traffic. This effectively gives less confident cyclists more confidence to overcome the physical and psychological “barrier effect” created by wider arterial streets.



APPLICATIONS:

Median refuge island diverters are appropriate for an intersection where there is an impetus to restrict vehicular left turns or to reduce traffic volumes by eliminating through and left-turning vehicle movements. Median refuge island diverters are most commonly used where a minor street such as a Neighborhood Greenway intersects a major street with multiple lanes of traffic in two directions. Because they provide safer, protected, two-stage crossing for cyclists and pedestrians, median refuge islands are recommended for unsignalized, offset intersections which are more complicated to negotiate.

BASIC COMPONENTS



Required

- Medians can be built at sidewalk grade with concrete or asphalt and curbing, or flush with the roadway using striping and temporary materials
- 4" double white retroreflective solid dashed stripes in lieu of concrete
- Mountable vertical barrier element(s), such as curb, parking stops or vertical delineator posts, shall be used along the perimeter of the bicycle refuge
- Standard MUTCD bicycle pavement marking
- Crossbike marking leading into the refuge and out to the receiving bikeway
- Reflective vertical elements and/or signage at the leading corner
- Reflective signage indicating right turn required for vehicles approaching from the minor street
- Drainage should be directed to the roadway catch basins

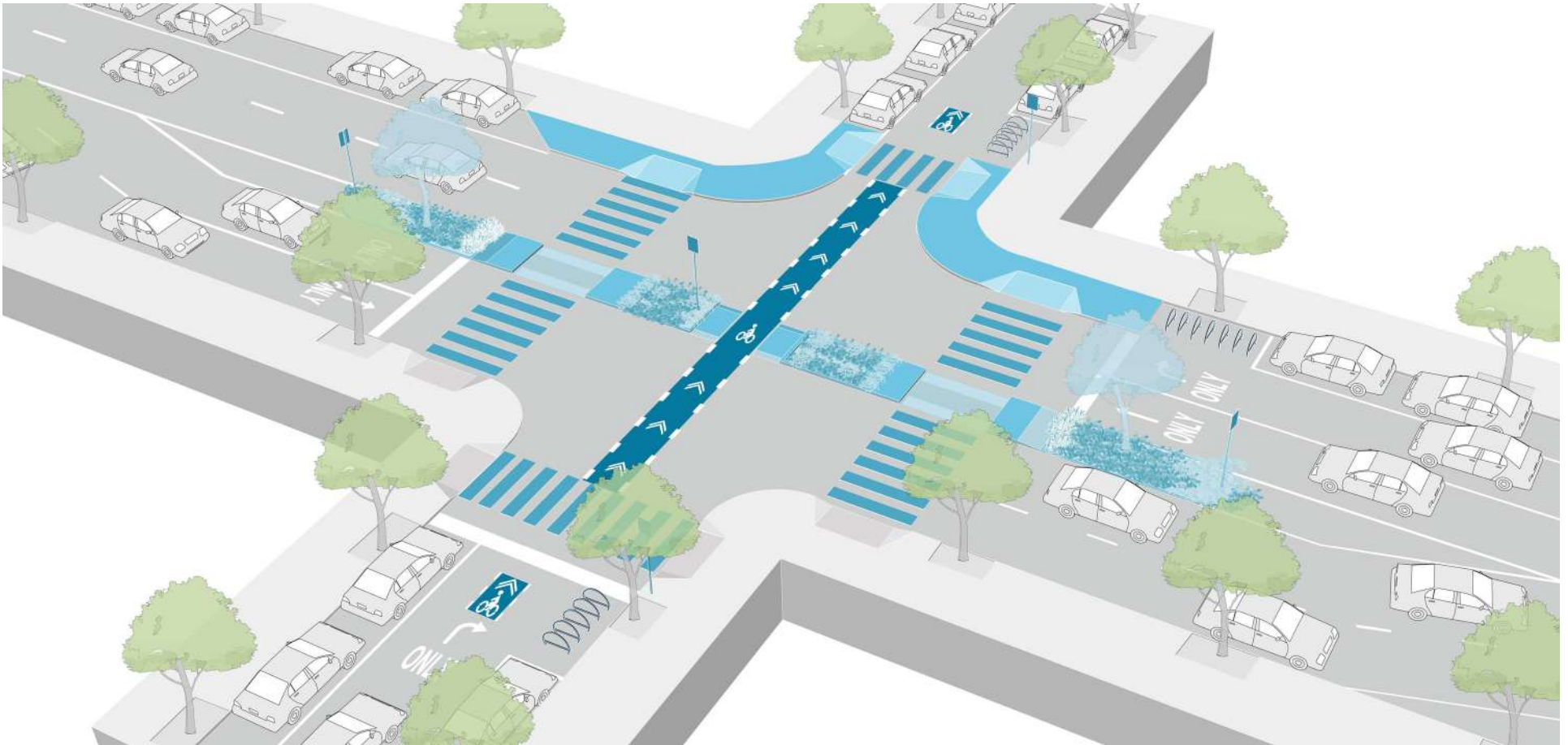
Recommended

- Green retroreflective crossbike marking bicycle refuge surface treatment if at the same grade as roadway
- Bicycle refuge marking stop bar
- Yellow retroreflective bicycle refuge island splitter lines for vehicle approach
- Trees or plantings set back from crosswalk

Optional

- Retroreflective object marker signage
- Planters with built-in hand and footrest may be used to add comfort
- Circular / rectangular planter may be used as barrier elements
- Bike box may be used to help direct bicycle refuge crossing

DESIGN DIMENSIONS



Required

- Bicycle refuge island should be 6' minimum in width, 8' preferred
- A minimum of 9' shall be provided between mountable vertical barrier elements; 14' between non-mountable barrier elements to allow for emergency vehicle access
- Bicycle refuge island slot shall be a minimum of 5' in width

Recommended

- Bicycle refuge stop bars should be used and be 12" in width

DESIGN NOTES

- Vehicular left-turns shall be restricted wherever bicycle refuge islands are created.



SE 17th Avenue and Clinton Street , Portland. OR
(M. Andersen/BikePortland)

1e. Mini-Roundabout

Mini-roundabouts, or neighborhood traffic circles, simplify vehicle turning movements and lower vehicle speeds at intersections. These traffic-calming facilities have been shown to improve safety, air quality, and reduce noise pollution. Roundabouts can be installed using road markings, and vertical quick-build elements. In the long-term, the implementation of permanent roundabouts / neighborhood traffic circles offer opportunities to beautify streets through greenery and / or artistic installations.



APPLICATIONS:

Mini-roundabouts are appropriate for the intersection of two-way, low-volume residential streets, especially where there are no existing traffic controls. They are recommended wherever two two-way Neighborhood Greenways intersect.

BASIC COMPONENTS



Required

- A center island with a flushed or mountable apron if permanently constructed with concrete or a 4" retroreflective double white or 1' single perimeter stripe in lieu of concrete

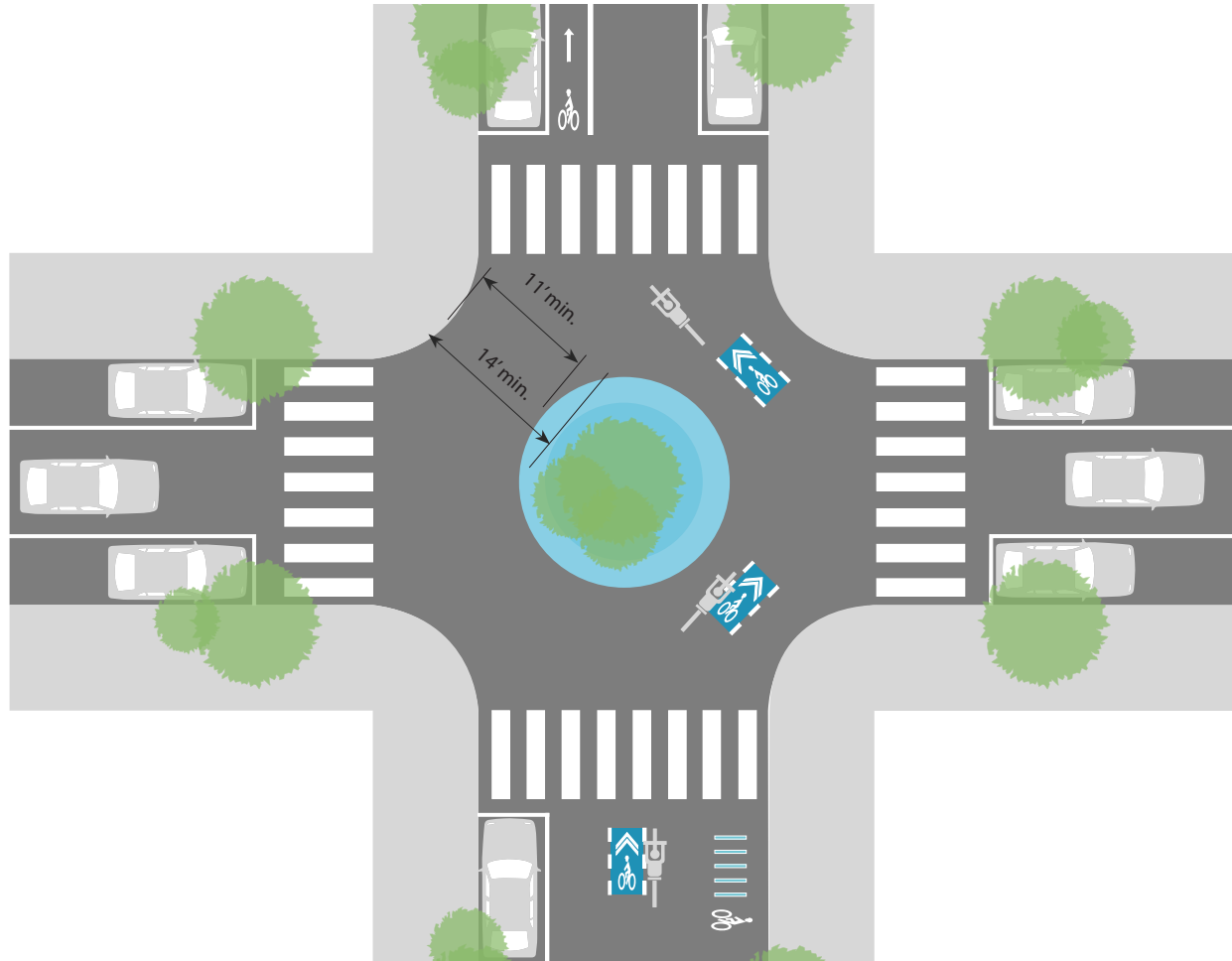
Recommended

- Circular intersection W2-6 roundabout sign or similar on all approaching streets
- Surface material should be used to more visibly designate the mini roundabout and any splitter islands
- Round planters should be used to increase verticality and aesthetics if using temporary materials
- Yield line markings should be placed in advance of the intersection
- Chevrons or super sharrows to reinforce the direction of travel

Optional

- Retroreflective object marker signage
- Yield signage on the approach road
- Splitter Islands may be used to calm and deflect vehicular traffic approaching the intersection
- Splitter Island should be demarcated by 4" double white or yellow perimeter stripe if used
- Ceramic markers, rubber speed humps, armadillos, delineators and other barriers may be used to define the perimeter of the roundabout or splitter islands
- Mural surface treatment may be used but shall not to be paired with full intersection murals

DESIGN DIMENSIONS



Required

- Mini-roundabouts shall maintain 15' clear between any curb and vertical element used to define the roundabout island
- Travel lanes shall be a minimum of 9' between the curb and the nearest edge of the splitter island (if used), and a maximum of 11'

Recommended

- Mini-roundabout island dimensions will vary, but 10' diameter is common

ADDITIONAL DESIGN GUIDANCE

- Mid-point of the center island should be positioned where diagonal curb to curb lines intersect.
- The design must allow emergency and design vehicles to make a turn in front of and/or over any mountable vertical barrier elements.
- Partner with community organizations and /or city contractors to maintain planters and street murals.
- Consider removing stop signs wherever feasible.



10th Avenue mini roundabout, Seattle, WA
(Street Plans)

1f. Diagonal Diverter

Diverter are used to slow vehicles and reduced volumes along residential streets. They are primarily comprised of physical barriers that prevent the free flow of motor vehicle traffic in a particular direction. Diagonal diverters force motor vehicle traffic in all directions to turn, except for people using smaller, low-impact modes of transport like bicycles, scooters, and skateboards, which are allowed to go through by means of a small opening and accompanying signage. Diagonal diverters can be used on one-way or two-way streets (which generally requires a stop control).



Diagonal diverter (Paul Krueger)

APPLICATIONS:

Diverter should only be applied to moderate-volume residential thoroughfares where traffic calming measures are still deemed necessary to achieve target volumes. Diverter can break up traffic grids while maintaining permeability for cyclists, pedestrians, and users of other small impact modes of transport. Diverter are a common treatment used to reduce cut-through traffic along Neighborhood Greenways, or streets where residents desire to minimize through traffic. Special consideration must be taken for the availability, capacity, and appropriateness of the alternative routes drivers might pursue if a diverter is constructed. Special consideration must also be given to the geometric requirements for turning vehicles (especially trucks) as well as local access for emergency vehicles. Diverter are not appropriate for truck or bus routes or emergency through routes such as streets with hospitals, police and/or fire stations.

DESIGN GUIDANCE

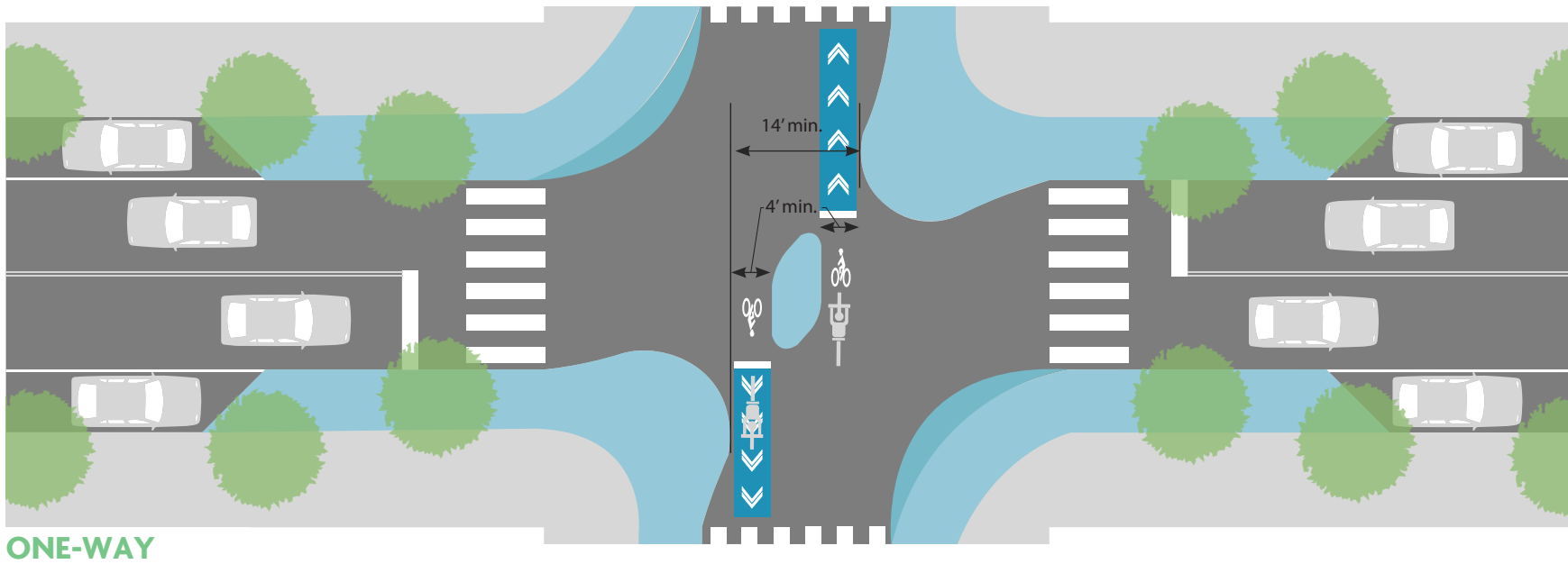
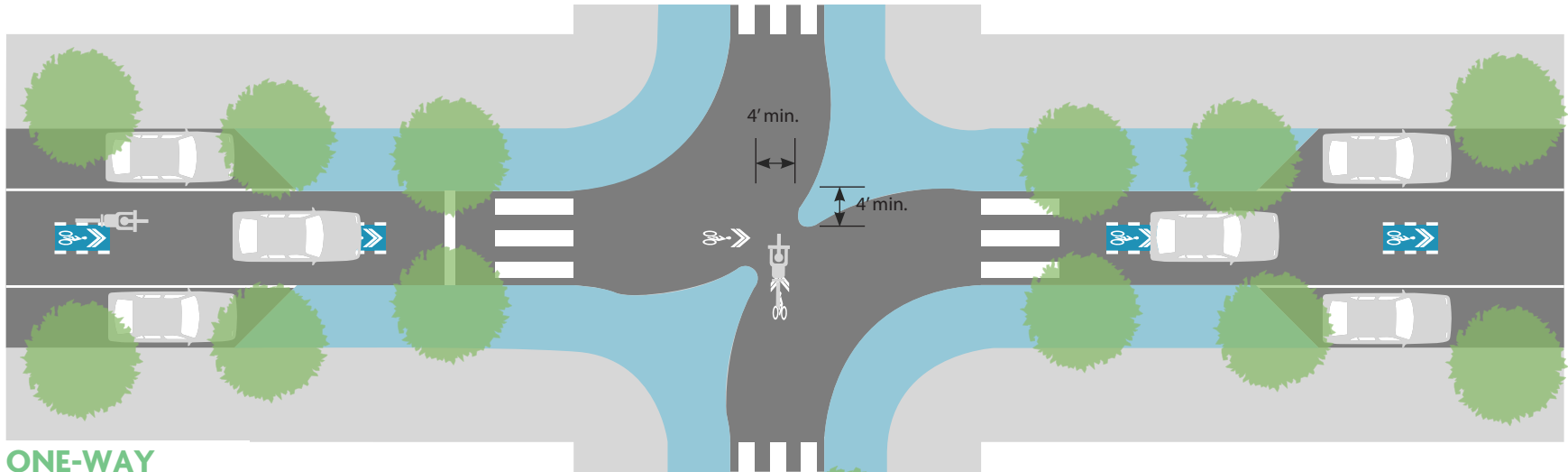


California Street diagonal diverters
Berkeley, CA (Street Plans

- All diverter treatments should provide bicycle access through a 4-foot minimum opening, with 6' minimum between vertical elements such as curbs, plantings, and sign poles.
- Clear widths sufficient for single-unit trucks to make turns without encroaching on opposing lanes should also be provided.
- Where emergency vehicle access is required, an absolute minimum of 10 feet of clear space shall be maintained between a diverter's vertical features.
- Design features, such as mountable curbs, flexible or collapsible bollards, or restricted lanes may reduce these space requirements.
- Turns for larger vehicles can be accommodated with mountable aprons.
- Diverters create additional space that can be used for plantings, green infrastructure, seating, bike parking, and other amenities.
- Drainage should flow to roadway catch basins.
- Appropriate signs and pavement markings should be used to increase visibility and prohibit undesired automobile movements and access while permitting desired bicycle or pedestrian access.
- Temporary quick build treatments may be used to measure impact and resident/business support prior to finalizing the design.

DESIGN IN CONTEXT





2. PROGRAMMING

It is worth reiterating that Neighborhood Greenways are not merely a painted bikeway facility. They are a whole different kind of street that is more attractive and more livable and should be thought of as a network of their own.

They have less vehicle traffic, incorporate green infrastructure elements, and encourage social street life, active uses, and recreation of many types. Cycling is just one kind of activity you may find on a neighborhood greenway, but this can also include jogging, informal team sports, games, events, and a range of amenities to support these kinds of activities. With greatly diminished importance for the larger vehicle transportation network, neighborhood greenways lend themselves well to temporary closure to vehicles for small scale events after school and on weekends and holidays. This section includes just a few ideas and examples of programs and improvement which are recommended for neighborhood greenways. To make the neighborhood greenway program successful, it is recommended that the city commit a small amount of recurring annual funding to purchase and maintain equipment and provide microgrants to community groups who want to enliven their streets.

GROUP RIDES

Organized group rides are a way to promote and celebrate the neighborhood greenway network and encourage cycling by novice users. Cities may partner with local groups and cycling organizations to plan and execute these rides. They should be family-friendly and targeted outreach should be made to generate participation from people of all ages along the route - these rides are intended to be a program for the benefit of local residents more than a tour for outside cyclists. Rides may include component activities like learn to ride classes, bicycle maintenance classes, helmet fittings, bike swaps, and food & beverage at the end. Rides may also pair up with larger car-free events like open streets or block parties.

PLAYSTREETS

Playstreets involve closing a street to through vehicle traffic at a recurring time and day to allow for active recreation. These can be especially useful for blocks where are further from parks and playgrounds. Activities might include bicycling and skateboarding, games like tag, jump rope, and hopscotch, and pick-up sports like soccer, roller hockey, frisbee, or whiffle ball. With a little bit of added equipment, you can also have basketball, sprinklers, lawns, blocks, and even mini libraries. With a designated manager for the street closure, it is still possible to allow for escorted vehicle access.

FIX-IT STATIONS

Fix it stations support bike maintenance with an air pump, repair stand, and basic tools secured by steel cables. Besides just being a place to pull over when you have an issue, they can be a place for residents to bring their own bikes when they want to perform basic maintenance, and they can also be used to host bicycle repair clinics. In order to have the station cleaned and stocked, it is recommended that it be maintained through a partnership with a willing local business or organization.

BENCHES + GAME TABLES

Benches along a neighborhood greenway encourage more residents to walk and gather outdoors. They are especially useful for seniors and people with health or mobility issues - knowing that there is a place to periodically stop and rest along a route may considerably extend their comfortable walking distance. Benches in clusters can be combined with games tables to foster more community street life. Games could include chess, checkers, dominos, backgammon, or even ping-pong, bocce, or petanque, where space allows.

FITNESS EQUIPMENT

Similar to larger installations in parks, playgrounds, and along trails, permanent small-scale fitness equipment can compliment the other physical activities on neighborhoods greenway. These can be sited in curb extensions, along curbs, or in dedicated corrals. Given their location on an active street, this kind of equipment would generally be oriented to teenagers and adults, unlike children's play equipment which may require more safety features and containment.

MID-BLOCK PLAYGROUND

As another aggressive traffic calming treatment, streets can be closed mid-block to create a public space for residents. This public space can feature various play equipment or a full-scale playground. This concept is similar to the superblocs of Barcelona and an example can be found on St. Mark's Avenue in Brooklyn and a citywide program using this prototype was recently recommended by NYC Comptroller Scott Stringer. The street with this treatment will need to be designed to allow for vehicle turn around movements and emergency vehicle access. Vehicles can be restricted at street entrances using a post and chain or other managed access system.



Play Street, Seattle, WA
(City of Seattle)



Hancock Avenue Block Party
Jersey City, NJ (Unknown)

INTERSECTION TREATMENTS

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3. INTERSECTION TYPOLOGIES	112

Street intersections are areas of particular concern for cyclists because they are where crashes are most likely to occur. This is especially true in Jersey City where there is a preponderance of misaligned and T-shaped intersections which increases the number of turning movements a cyclist is likely to have to make on a given trip.

Along bike routes, special consideration should be given to the needs of cyclists for stopping, starting, navigating, turning, and queueing, among other cycling actions that take place at intersections. To design safer intersections for cyclists, this chapter provides a palette of standard, highly-visible pavement markings and design elements which are intended to organize movements, minimize conflicts, and increase visibility for and between different modes of travel.



York Street, Jersey City, NJ
(Street Plans)

1. INTERSECTION DESIGN ELEMENTS

1a. Crossbike Markings

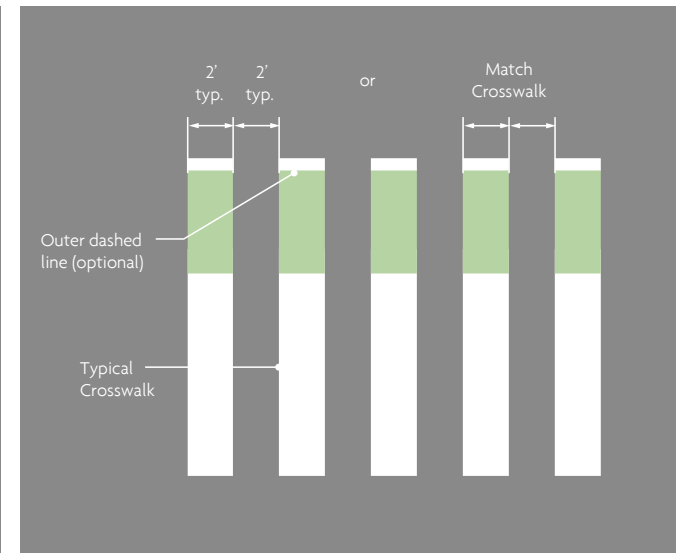
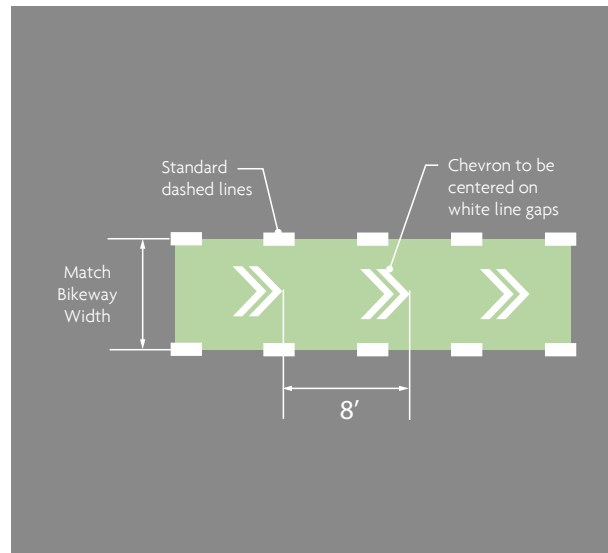
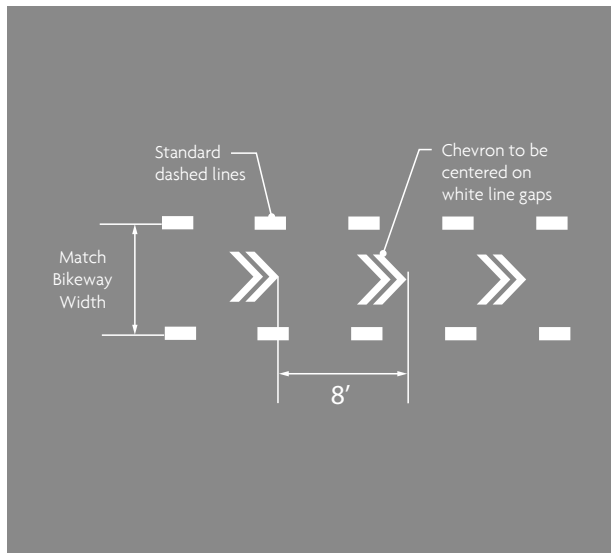
Crossbike markings highlight the path of bicyclists through an intersection or across a driveway or curb cuts where conflicts with motor vehicles occur. They are intended to improve the visibility of bikeways and cyclists to motorists and help motorists and cyclists predict each other's lateral positioning while moving through a given intersection or across a driveway.



APPLICATIONS:

Crossbike markings, which vary in design, are appropriate across signalized intersections, especially those that are wide or complex, and may be used in conjunction with protected bikeways, bike lanes, and even sharrows. They are especially appropriate where motor vehicles must encroach into the bike lane to access a ramp, driveway, or intersecting street.

CROSSBIKE DETAILS

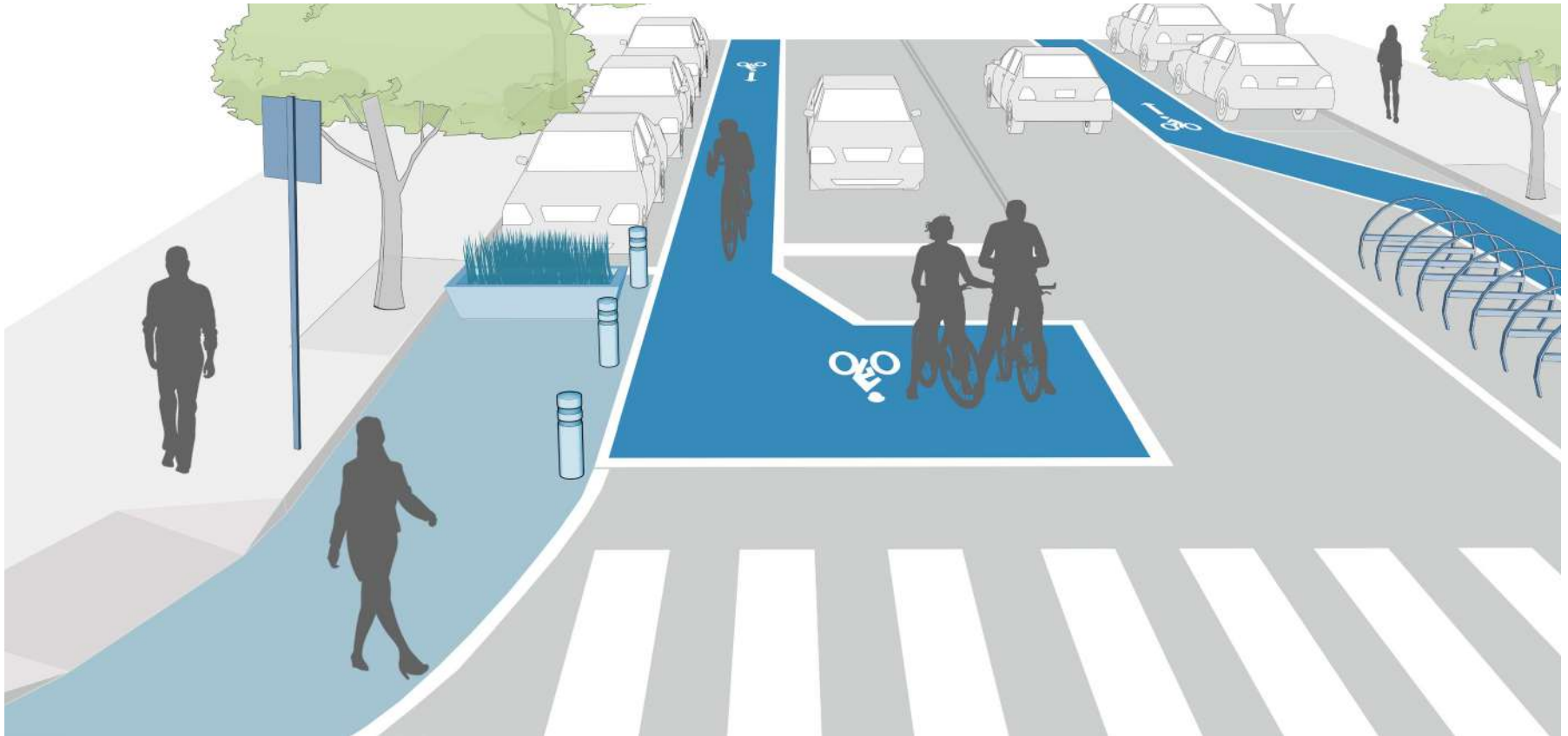


DESIGN GUIDANCE

- At a minimum, crossbike markings are comprised of dashed painted lines, which are supported by Section 3B.08 of the MUTCD.
- The dashed markings are typically 2 - 3 feet in length, and 6 inches in width, spaced 2 - 6 feet apart.
- The crossbike width should match that of the bikeway leading into the intersection.
- In addition to the dashed line treatment, cross-bikes may include chevrons, sharrows, or colored paint, which may be used to differentiate the bike portion of the crossing from the pedestrian crosswalk. So-called “Elephant’s feet” markings (14 - 20-inch square markings) are occasionally used to further emphasize the cross-bike treatment.
- The use of chevrons is recommended for all locations where bike lanes intersect with opposing vehicle traffic such as at intersections and driveways.
- Green paint is recommended for intersections with high traffic volumes, multiple conflicts, contra-flow movements, and where cyclists may cross the path of vehicles approaching from behind them.

1b. Bike Box

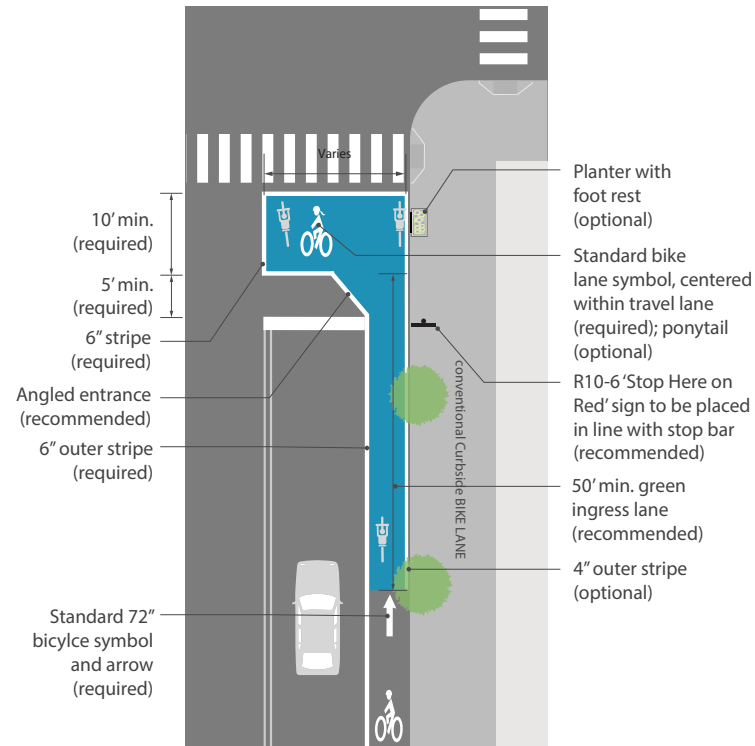
A bike box is a designated area for cyclists to wait for a green light in front of vehicle traffic at a signalized intersection. They provide a safe and visible way for cyclists to position themselves ahead of traffic during the red signal phase to either proceed straight through the intersection or to make a left turn to an intersecting bikeway.



APPLICATIONS:

Bike boxes are typically applied at signalized intersections of one- or two-way streets with moderate to high bicycle/vehicle traffic, especially those where cyclists must make left turns (typically into an intersecting bikeway, shared use path or where the bicycle lane moves to the left side of the street). Bicycle boxes may also be used in conjunction with shared use lane / "super sharrow" markings and/or where pedestrian traffic is high, as the advanced vehicular stop bar discourages motorists from encroaching on the crosswalk.

BIKE BOX DETAILS



DESIGN GUIDANCE

- The bicycle box should be between 10 and 16 feet deep, and be accompanied by a stop bar to minimize encroachment by motor vehicles.
- The bicycle pavement marking should be centered between the stop bar and crosswalk to reinforce the bicyclist's priority.
- "No Turn on Red" signs (MUTCD R10 - R11, R10- R11A, R10 - R11B) should accompany the bike box to prevent vehicles from entering it and compromising the safety of cyclists with "right hook" turns.
- To enhance its visibility, the bike lane approach and bike box itself may be colored with green paint, include a "Wait Here" legend marking for motorists, and/or include a stop line 8 feet in advance of the actual bike box.
- Bike boxes may also be paired with bicycle signals or leading pedestrian intervals to further reduce turn conflicts with motor vehicles.

1c. Two-Stage Queue Box

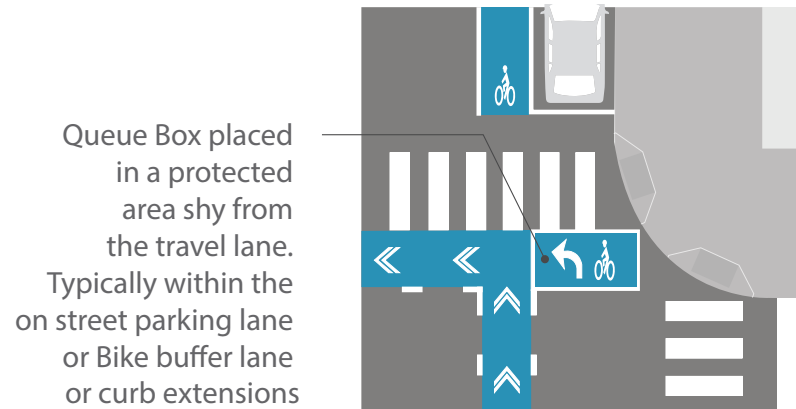
Bicycle queue boxes allow cyclists to make safe, “two-stage” left turns at an intersection from a right side bikeway — typically a protected, buffered, or conventional bike lane — or right turns from a left side bikeway. While the signal is green, cyclists enter the intersection and stop inside the green queue box, waiting to turn. Once the signal in the other direction turns green, the cyclist then makes a left turn onto the intersecting street. They are intended to improve cyclists’ ability to make left turns comfortably while reducing conflicts with motor vehicles and/or pedestrians.



APPLICATIONS:

Bicycle queue boxes are most appropriate at signalized intersections, on multi-lane thoroughfares with high speeds or volumes, along protected bikeways where cyclists need to exit the lane to turn left, and especially at intersections where cyclists make frequent left turns for a major destination or for an intersecting bikeway.

TWO-STAGE QUEUE BOX DETAILS

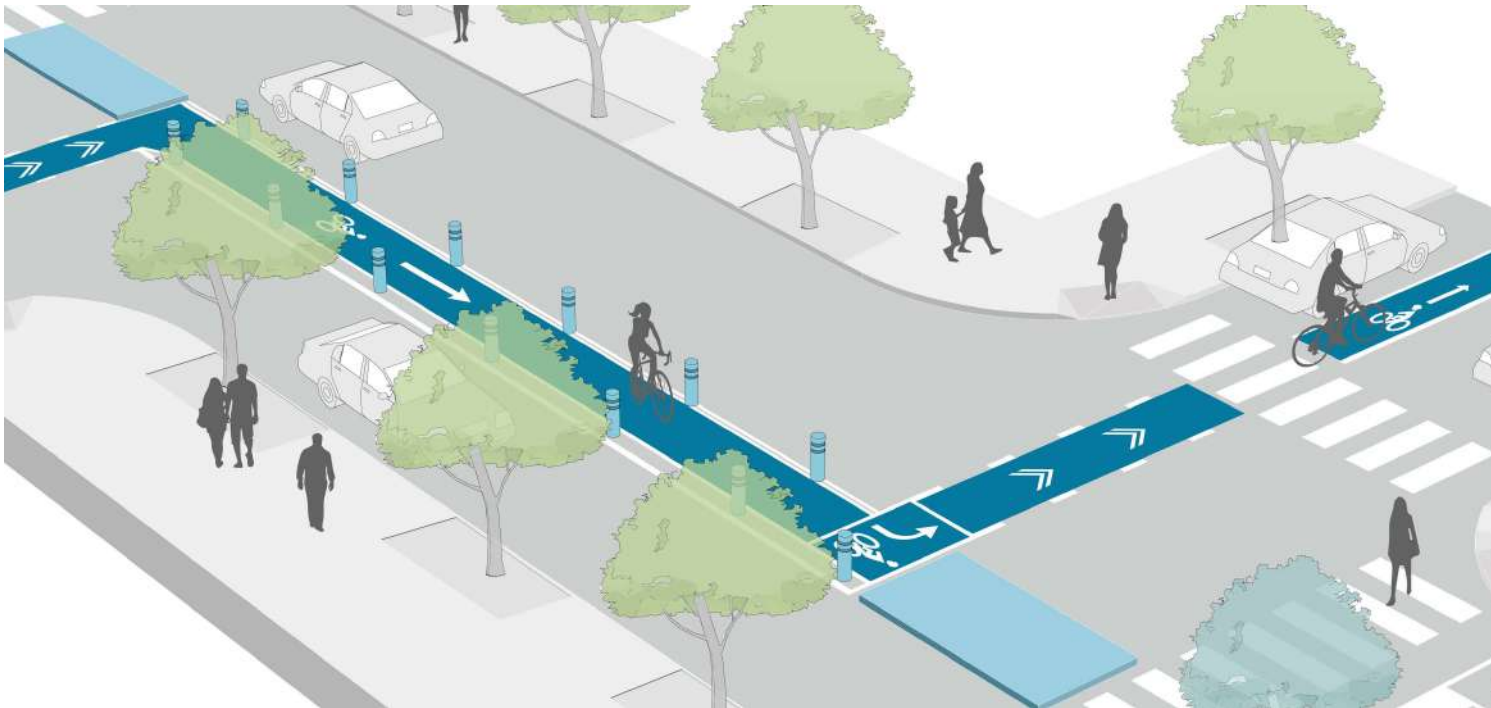


DESIGN GUIDANCE

- Bicycle symbol and arrow markings are required for queue boxes. Additional signage is not required, but may be helpful for drivers to understand the queue box's function, and to enhance the safety of cyclists using it.
- The box should be placed in a safe, protected area within the intersection, such as in line with the parking lane, or between the continuing bike lane and a pedestrian refuge island.
- “No Turn on Red” signs (MUTCD R10 - R11, R10- R11A, R10 - R11B) should accompany the queue box to prevent conflicts with motor vehicles.
- “Cross-bike” intersection markings should be used to aid bicycle positioning through the intersection and ideally be accompanied by a bicycle signal, with a leading bicycle interval to improve the comfort and visibility of cyclists moving through the intersection.
- Bicycle queue boxes are often combined with an underlying green paint treatment for extra visibility and may also be placed laterally in the cross street parking lane, rather than in front of the travel lane.

1d. Median Left-Turn Bay

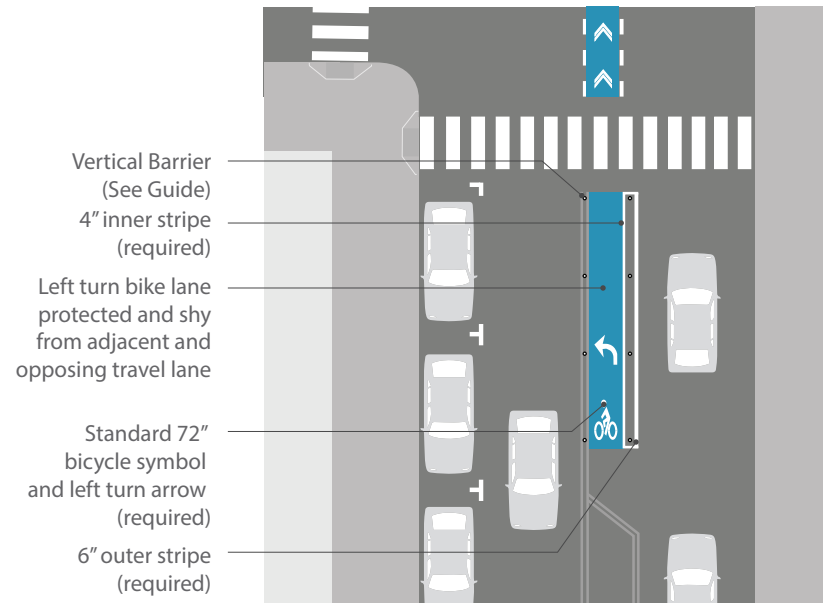
Median turn lanes specifically designed for cyclists can be added to the center of the roadway at an intersection to allow cyclists a refuge in which to wait to turn onto a street with a bike facility. This is especially useful for offset intersections where a bikeway continues after a jog or “dog leg” across an intersecting street. In that scenario, cyclists turn into the median turn bay of an intersecting two-way street, and then immediately make another turn to continue on the bikeway. As cyclists approach from the first neighborhood greenway segment, they turn onto the cross street, then merge across one direction of traffic into the median turn bay, where they have a protected space to wait for a gap in traffic. This treatment is appropriate for two-way streets where the street width, motor vehicle speeds, and volumes are low enough on the cross street so that there are sufficient gaps in which to safely proceed.



APPLICATIONS:

Center left turn bays are recommended where cyclists make left turns from a major street to a minor street with a bikeway, at intersections that do not have signals. If the intersection has a traffic signal, a bike box or queue box may be more appropriate.

MEDIAN TURN BAY DETAILS



DESIGN GUIDANCE

- Space for center island turn bays can be achieved by removing parking leading up to the intersection and shifting moving lanes of traffic to the curb with a 20'-30' taper (See Median Refuge or Offset Intersections).
- Bicycle symbol and arrow markings are required for turn lanes. Additional signage is not required but may be helpful for drivers to understand the turn lane's function, and to enhance the safety of cyclists using it.
- Use of flush or raised medians/pedestrian safety islands restricting motorist turn movements is optional, as a median left turn bay can be provided while still permitting left turns for motor vehicles with a narrow curb island or bollards.
- "No Left Turn" with "Except Bicycle" signs may accompany the turn bay or median if vehicular left turns are prohibited.
- The receiving areas on intersecting bikeways should be aligned.
- "Cross-bike" intersection markings should be used to aid bicycle positioning through the intersection and could be accompanied by a bicycle signal, and/or a leading bicycle interval to improve the comfort and visibility of cyclists moving through the intersection.

1e. Protected Pocket Lane (Ingress)

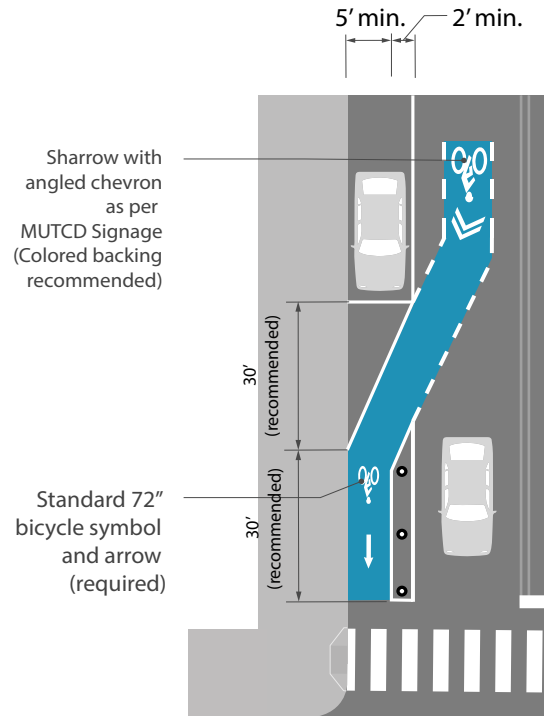
Protected pocket lanes include a physical barrier between the bikeway and adjacent vehicular travel lane. Depending on the context, protected pocket lanes may require the removal of the last few curbside parking spaces to make room for a curbside bike lane with a striped buffer and vertical barriers (bollards, curbed median, etc.). On streets that have shared bike/vehicle lanes, protected pocket lanes also give cyclists a comfortable place to let trailing vehicles pass. This facility type may also be used at any point along a bikeway where an unprotected lane, transitions to a curbside protected lane.



APPLICATIONS:

Protected pocket lanes may be used at any intersection with a bikeway facility. It is especially beneficial on streets that do not otherwise have protected bike lanes but have moderate to high vehicular traffic volumes. It can also be implemented on streets where there is not a dedicated right turn lane, but on which turning traffic may cause conflicts between people driving and cycling.

PROTECTED POCKET LANE (INGRESS) DETAILS



DESIGN GUIDANCE

- Use directional bikeway markings to guide cyclists into the protected area.
- Minimum 5' bike lane width.
- Minimum 2' buffer width.
- Minimum 5' pedestrian island width (if using).
- Minimum 5' taper, 20' recommended.
- Extend the buffer or median into the crosswalk to provide pedestrian protection whenever possible.
- Include 12" wide stop bar behind crosswalk at controlled intersections.
- Apply yield line markings at the crosswalk if there is no signal or stop control.
- Consider yield stencil and "Bikes yield to peds" sign.
- Use leading pedestrian/bicycle interval signal to give cyclists a head start at green lights.
- Use vertical elements (e.g. bollards, planters, quick curb) in the buffer and at the front end of the parking lane.

1f. Protected Pocket Lane (Egress)

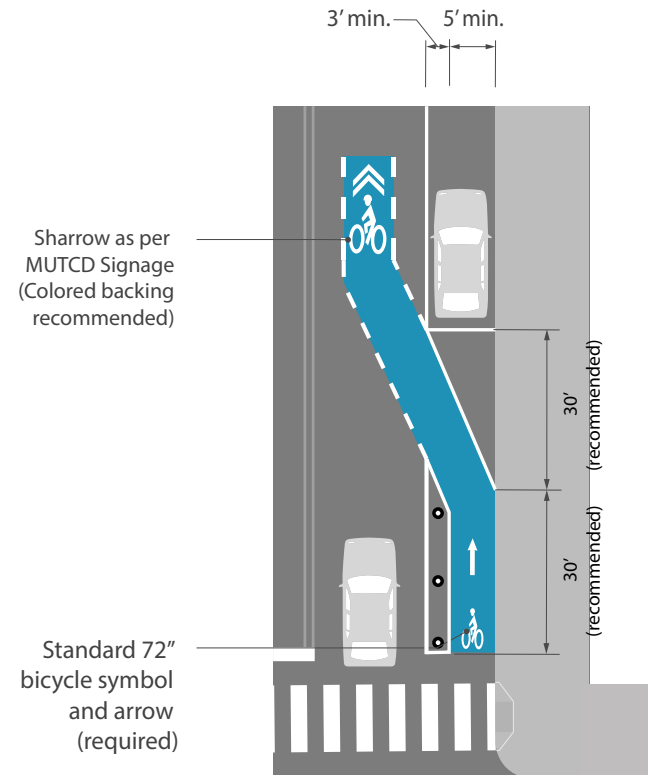
Protected pocket lanes for egress conditions is exactly like the intersection ingress but in reverse, as they provide a safer, protected transition between an intersection and an unprotected or shared lane. This treatment is most common on the far side of an intersection with protected ingress, or any point on a bikeway where there is a transition from a protected condition to an unprotected condition.



APPLICATIONS:

Protected pocket lanes for an intersection egress condition is appropriate for all intersections where vehicular turn movements cross a parallel bike lane. It is especially useful on streets that do not have protected bike lanes because it provides the benefits of protection at intersections where the dangers are greatest. They can also be implemented on streets where there is not a dedicated right turn lane, but on which moderate to significant volumes of turning traffic may cause conflicts between people driving and cycling.

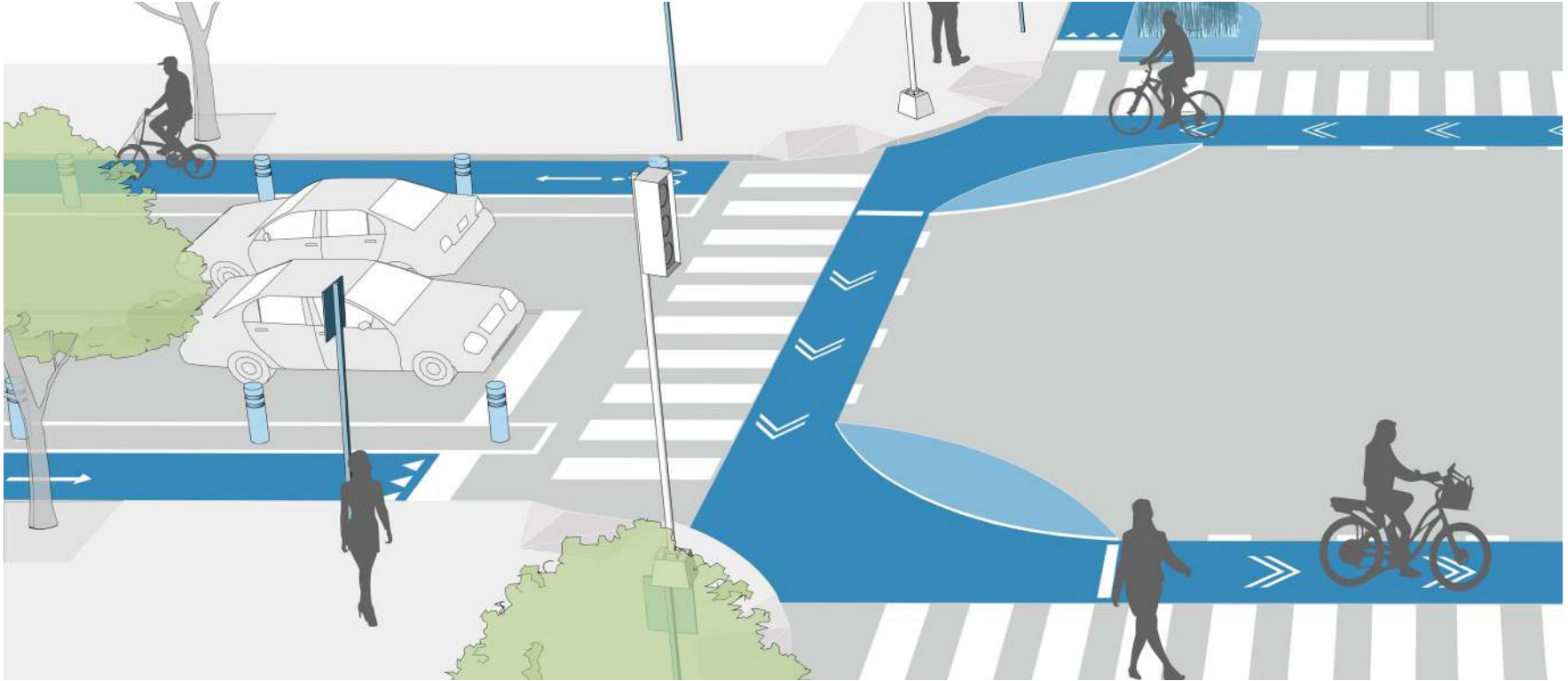
PROTECTED POCKET LANE (EGRESS) DETAILS



DESIGN GUIDANCE

1g. Corner Safety Island

A Corner Safety Island is a lens-shaped area at the corner(s) of an intersection which separates the bike lane from the vehicular travel area and defines the turning radius of the intersection corner. The island provides comfort and protection for queueing bicyclists and crossing pedestrians and reduces the speed of turning vehicles.



APPLICATIONS:

Corner safety islands are appropriate for the near side corner of any intersection where motor vehicles turn across the path of a parallel bike lane and are recommended for any streets where two bikeways with dedicated lanes intersect. Priority should be given to locations with high volumes of turning vehicles, or documented safety issues.

BASIC COMPONENTS



Required

- High-visibility crosswalks
- Standard MUTCD bicycle pavement markings with directional arrows
- Crossbike markings across vehicle travel lanes
- Yield lines before crosswalks

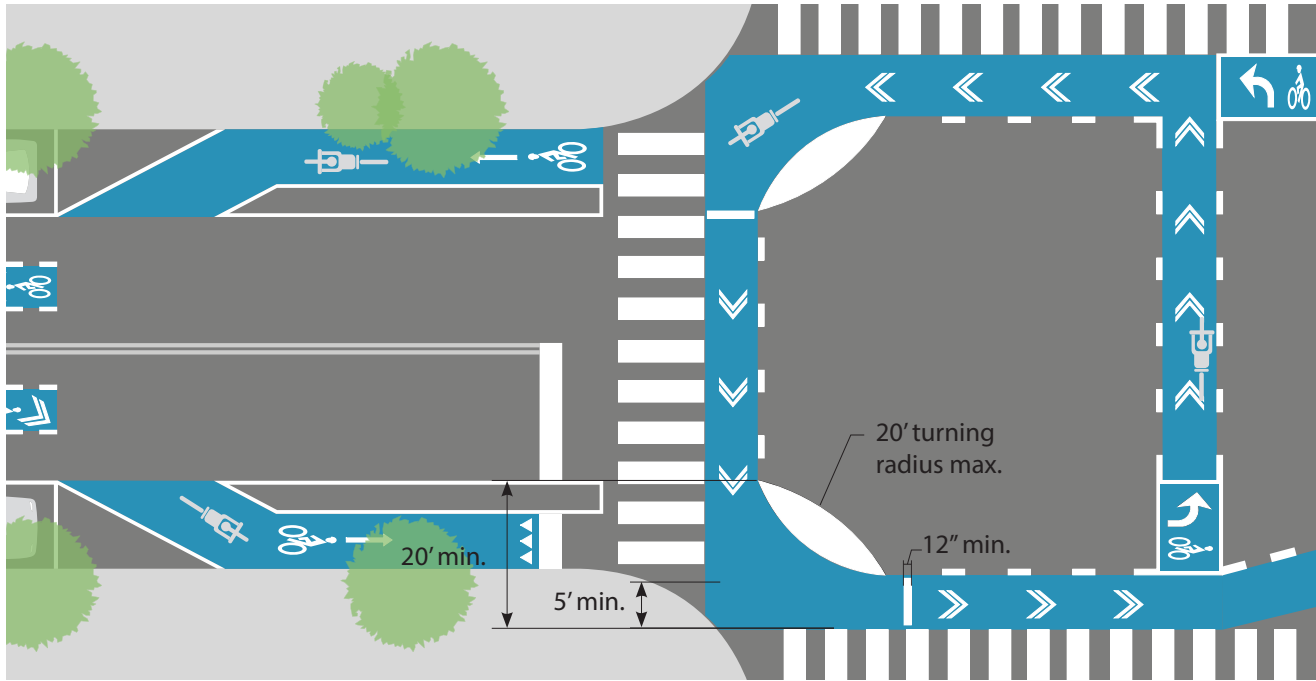
Recommended

- Protected pocket lane for ingress/egress
- Green retroreflective intersection egress/ingress lanes and crossbike markings
- Vertical barrier elements (e.g. delineators, curbed island) for turning radius island
- Median refuge island
- “Turning vehicles yield to bikes” signs for drivers

Optional

- Size restrictions for turning motor vehicles
- Forward stop bar
- “Yield to pedestrians” signs for cyclists
- Bicycle traffic signal or leading bicycle/pedestrian interval
- Mountable corner safety islands or turning apron
- Cyclist yield line markings
- Circular / rectangular planter may be used as barrier elements
- Planters with built-in hand and footrest may be used

DESIGN DIMENSIONS



DESIGN GUIDANCE

- Traffic volumes may require exclusive turn lanes, signals, and signal phases.
- Consider tapering bicycle approach to ease transition to intersection setback crossing.
- In select conditions achieving the desired dimensions may require impinging on existing sidewalk area and/or acquiring right-of-way for permanent construction.
- Special consideration must be given to street cleaning, snow removal, and emergency vehicle operations.
- Drainage should slope to the vehicular roadway.

Required

- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)
- Bicycle refuge island slot shall be a minimum of 5' in width
- 2' minimum buffer width

Recommended

- 20ft maximum turning radius of corner safety islands (informed by design vehicle)
- 20ft minimum crossing setback for turning vehicle storage
- Bicycle refuge stop bars should be used and be a minimum of 12" in width

Optional

- 10ft turning radius of corner safety islands
- Corner turn apron to accommodate large vehicle turns



Daylighting / curb extension along Central Avenue,
Jersey City, NJ (Street Plans)

1h. Daylighting

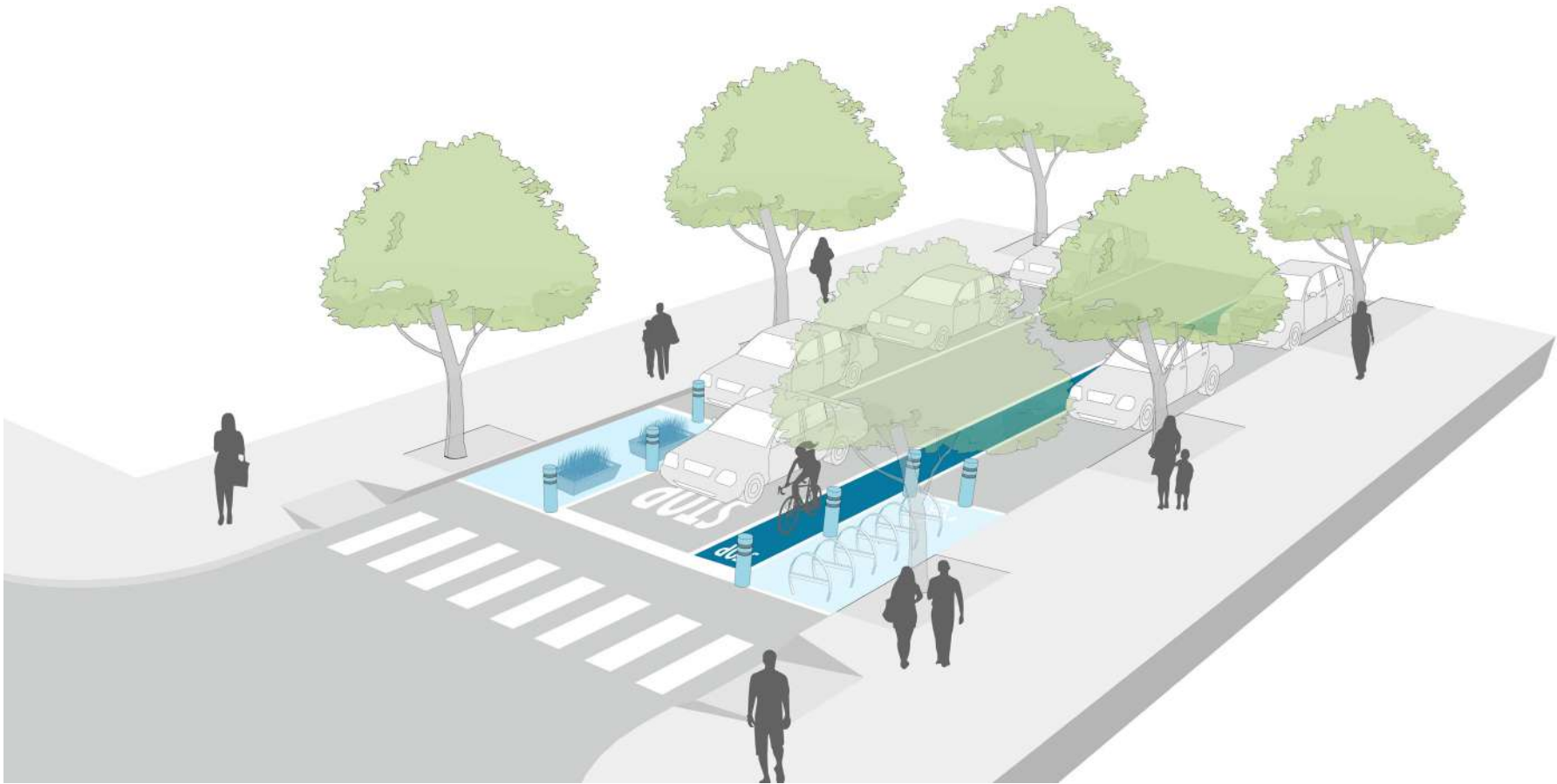
Daylighting involves restricting the curbside parking near intersections in order to improve sightlines where conflicts are more prevalent. This design technique allows people driving to negotiate tight turn movements while also increasing the visibility of other street users, such as bicyclists and pedestrians. Daylighting intersections also allows for the conversion of valuable street space into enhancements for people walking and cycling such as bicycle parking, seating, and greenery. While full curb extensions are the preferred treatment, simple daylighting is recommended wherever those are not warranted or desired.



APPLICATIONS:

Daylighting is appropriate for intersections on all streets with curbside parking and pedestrian crossings.

BASIC COMPONENTS



Required

- A single or double 4" white stripe (traffic paint, thermoplastic, or traffic tape) is used to demarcate the daylit area

Recommended

- Barrier elements such as parking stops, armadillos, ceramic markers or delineator posts should be used to ensure motor vehicles do not encroach into the sight triangle area
- A surface material (traffic paint, Ruby Lake Glass, or methyl methacrylate) should be used to more visibly designate the site triangle zone

Optional

- Murals may be used to delineate the sight visibility triangle area
- Circular or rectangular planters may be used for beautification and to further prevent vehicular encroachment
- Bicycle parking corrals, seating, and/or plantings may be added to daylighting zones

DESIGN DIMENSIONS



Required

- Daylighting zone width should be 1' less than parking lane width
- Daylighting zone will vary, depending on existing street dimensions and built context; 10' minimum length, 15 - 20' is typical

Recommended

- Add additional amenities within daylight zone (bike parking, murals, planters, public art etc.)

Optional

- N/A

DESIGN GUIDANCE

- When determining the daylighting zone dimensions, use the thoroughfare's desired target speed, rather than the design speed.
- Large corner radii with large daylighting zones may enhance visibility, but may also encourage people driving to speed, effectively diminishing any peripheral visibility gains retained at a slower speed.
- Because street corners and intersections frequently serve as gathering places for people, facilitate commerce, and accommodate bus stops, bicycle parking, and other amenities, the street design should focus on creating eye contact between people driving and all other street users, rather than focus on the creation of clear vehicular sightlines only.
- Traffic control devices must be unobstructed in the intersection and shall be free of tree cover or visual clutter.
- Where present, daylighting treatments may be used to further delineate 'no parking' zones for fire hydrant access.
- Where daylighting zones already exist, consider the addition of bicycle parking, painted curb extensions, planters, mural art, and/or other amenities.



Bike corral doubles as daylighting, Smith Street,
Brooklyn, NY (Street Plans)

2. TRAFFIC SIGNALS

2a. Bicycle Signals

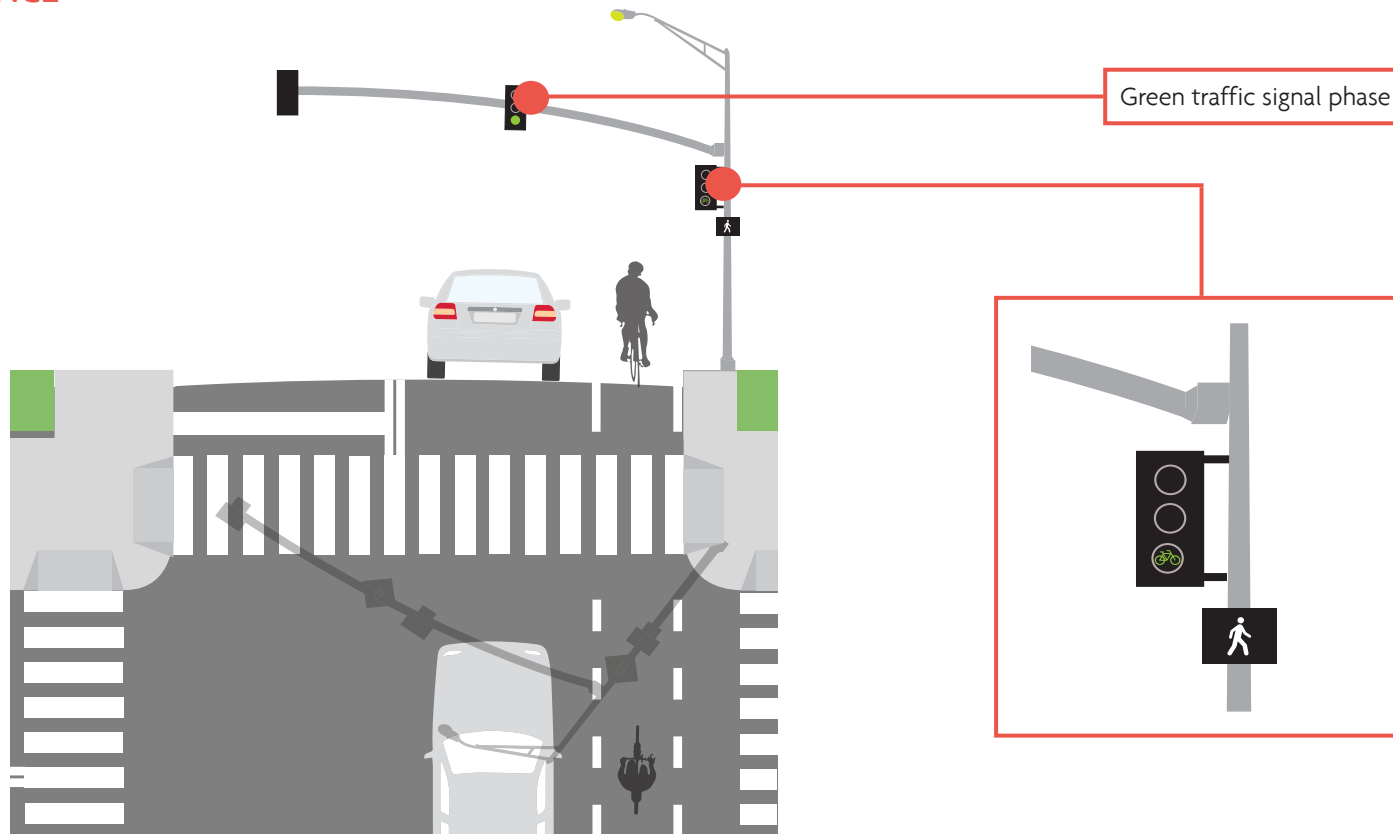


A bicycle signal is an electric, illuminated traffic control device that is used in combination with an existing conventional or hybrid (actuated) signal. They help separate bicycle-specific movements from conflicting motor vehicles, rail, or pedestrian movements. They use the same red/yellow/green colored lens pattern as traditional traffic signals and can be integrated with actuators such as push-buttons or bicycle detection systems. Determining which type of signal is best for a given location is based on numerous factors such as street width, traffic volumes for all modes, vehicle speeds, and types of facilities.

APPLICATIONS:

Bicycle signals are typically used to improve identified safety or operational problems with bicycle facilities at intersections or to accommodate cyclists at intersections where their movement patterns are different from other roadway users. Such signal heads may be installed at signalized intersections to indicate bicycle signal phases and other bicycle-specific timing strategies.

DESIGN GUIDANCE



ADDITIONAL DESIGN GUIDANCE

- Interim approval was issued via FHWA's MUTCD guidance for bicycle signals in 2013; see IA-16 for more details and conditions.
- A bike signal head should be placed in a location clearly visible to oncoming cyclists, either adjacent to or above the pedestrian signal head or in advance of the intersection as a supplement to far-sided signals
- A “Bike Signal” sign is required under MUTCD interim approval to reinforce the signal head
- Regardless of traffic turn volumes, No Turn On Red signs / enforcement is required.
- Where the bike signal is used to separate through bicycle movements from right-turning vehicles, a “No Turn on Red” sign is required
- Intersection crossing markings are also recommended
- The bike signal may also be timed to allow cyclists a head start through intersections of high-conflict (see leading bicycle interval)
- Ideally, bike signals should be actuated automatically, through detection methods or on a regular cycle
- If push button actuators are used, they should be installed so that cyclists do not have to dismount to activate them

2b. Leading Intervals

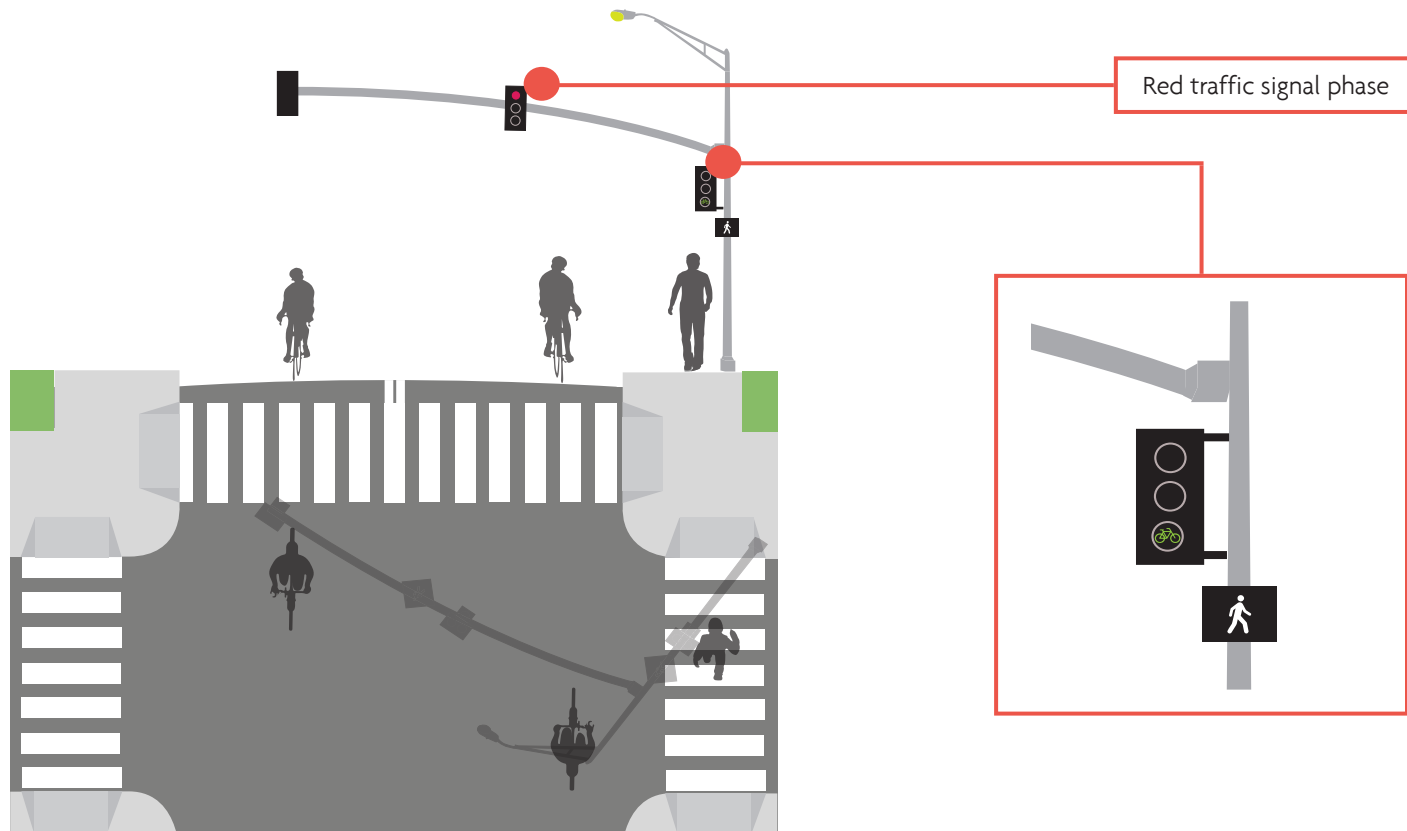
Leading intervals display a WALK indication for pedestrians and/or a green indication for cyclists while a steady red indication continues to be displayed to parallel through and/or turning vehicle traffic, thus affording pedestrians and cyclists a head start before conflicting vehicular turns are allowed to be made. The leading interval can be directed to cyclists either with a dedicated bicycle signal or with signage instructing cyclists to follow the pedestrian signal. Leading intervals give people walking and cycling more confidence and help reduce conflicts/crashes with people driving.



APPLICATIONS:

Leading pedestrian intervals are appropriate for any intersection where turning vehicles cross the path of pedestrians and cyclists but are most impactful at signalized intersections with high pedestrian volumes and a moderate to high volumes of turning vehicles, crash history, or where known conflicts between pedestrians and vehicles exist. LPIs can be of particular relevance in and around schools, areas with high senior or disabled populations, college campuses, employment hubs, and/or downtown/commercial districts. Any street with two turning lanes should have a leading interval for pedestrians and bicycles crossing the intersecting street. Note: A new Jersey City ordinance will be required to allow cyclists the ability to use LPIs.

DESIGN GUIDANCE



- The signal head is the same as in any signalized intersection with dedicated pedestrian or bicycle signals, just the timing of its activation is advanced to provide people walking and cycling with a head start.
- Signal heads should be located between 7 and 12 feet above sidewalk level, and be positioned and adjusted to provide maximum visibility at the beginning of the controlled crosswalk.
- The typical leading interval is between 3 and 7 seconds.
- When using the pedestrian signal to give cyclists the leading interval, include adjacent signage instructing cyclists to follow the pedestrian signal.

3. INTERSECTION TYPOLOGIES



Given the dangers for cyclists at intersections, every effort should be made to provide as much physical protection as possible, with organized movements, clear sightlines, high-visibility guidance, and well-marked bikeway facilities. Because intersections can have a wide variety of characteristics including traffic direction, alignment, turns, traffic controls, widths, traffic volumes, land uses, etc. the treatments in this chapter are presented as individual elements that can be installed in combinations based on site-specific conditions to provide the safest feasible configuration. What follows are examples of these elements in contexts to demonstrate how they might work together in a small handful of specific Jersey City conditions.

Bowers and Webster intersection approach,
Jersey City, NJ (Street Plans)



Atlantic and Bond left-turn “safety wedge,”
Brooklyn, NY (Street Plans)

3a. Protected Intersections

Protected intersections guide cyclists alongside curbs and crosswalks to minimize conflicts with turning vehicles while further providing corner safety islands as physical barriers for protection. The corner safety islands also reduce the turning radii for motor vehicles such that drivers make turns at slower speeds, are facing conflict zones directly from a front windshield view, and are more likely to yield to people walking and cycling. In this design, right-turning vehicles are typically at the slowest speed of their turn movement at the moment of conflict with cyclists and pedestrians. This is a key factor which induces greater yield compliance, and also reduces the likely severity of any crashes (should they occur). Cyclists waiting at red lights are given an advance waiting position providing an effective head start when the light turns green so they can enter intersections before people driving have a chance to turn.



APPLICATIONS:

Protected intersections may be a viable design for an intersection where there is sufficient right-of-way. Priority should be given to locations where two protected bike facilities intersect, and locations with high volumes of cyclists, vehicles, trucks, buses, turning vehicles, turning cyclists, or documented safety issues.

BASIC COMPONENTS



Protected intersection, Chicago, IL
(Streetsblog Chicago)

Required

- Corner safety islands
- High-visibility crosswalks
- Protected buffer on approach
- Standard MUTCD bicycle pavement markings with directional arrows
- Crossbike markings across vehicle travel lanes
- Cyclist yield line markings before crosswalks
- Forward stop bar
- Left-turn movements for cyclists at protected intersections are all marked as two-stage turns

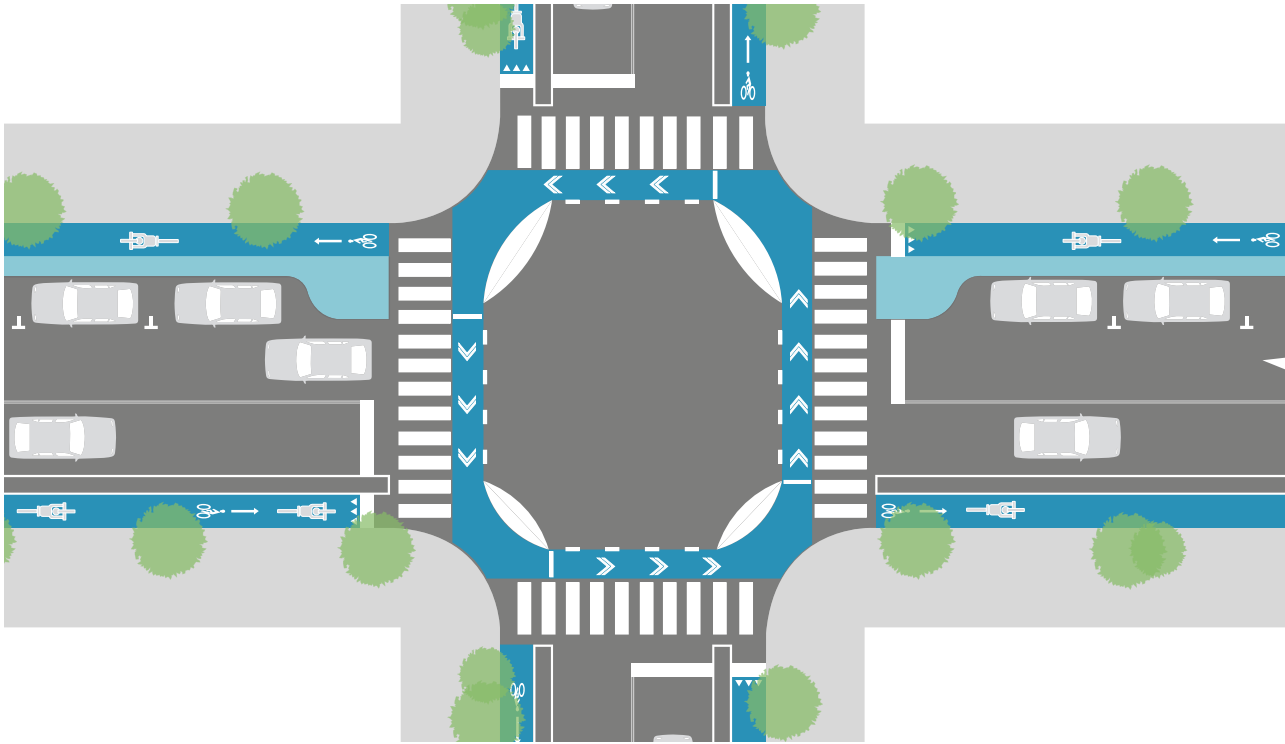
Recommended

- Green retroreflective bike lanes and crossbike markings
- Pedestrian safety islands
- “Yield to pedestrians” signs for cyclists

Optional

- Bicycle traffic signal or Leading bicycle/pedestrian interval
- Mountable corner safety islands or turning apron
- Tapered approach for narrower intersections
- “Turning vehicles yield to bikes” signs for drivers
- Circular / rectangular planter may be used as barrier elements
- Planters with built-in hand and footrest may be used to add comfort
- Pedestrian safety islands may integrate bike corrals, plantings, and green infrastructure
- Turning vehicle size restrictions

DESIGN DIMENSIONS



DESIGN GUIDANCE

- Traffic volumes may require exclusive turn lanes, signals, and signal phases.
- Consider tapering bicycle approach to ease the transition to setback crossing.
- Achieving the desired dimensions may require impinging on existing sidewalk area and/or acquiring right-of-way for permanent construction.
- Special consideration must be given to street cleaning, snow removal, and emergency vehicle operations.

Required

- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)
- Bicycle refuge island slot shall be a minimum of 5' in width
- 10' minimum spacing between sidewalk corner and corner safety islands
- 2' minimum buffer width

Recommended

- 20ft maximum turning radius of corner safety islands (informed by design vehicle)
- 20ft minimum crossing setback for turning vehicle storage
- 8ft minimum median refuge islands for bicycle queueing
- Bicycle refuge stop bars should be used

Optional

- 10ft turning radius of corner safety islands
- Corner apron to accommodate large vehicle turns



A "quick-build" protected intersection,
San Jose, CA (NACTO)

3b. Partially-Protected Intersections

For intersections where full protection using safety islands at all four corners is not feasible or not warranted, other elements may be used in combination to organize, protect, and highlight bicycle movements through the intersection. Every intersection with a bikeway should use some combination of these elements based on conditions and feasibility.



BASIC COMPONENTS

Required

- High-visibility crosswalks
- Standard MUTCD bicycle pavement markings with directional arrows

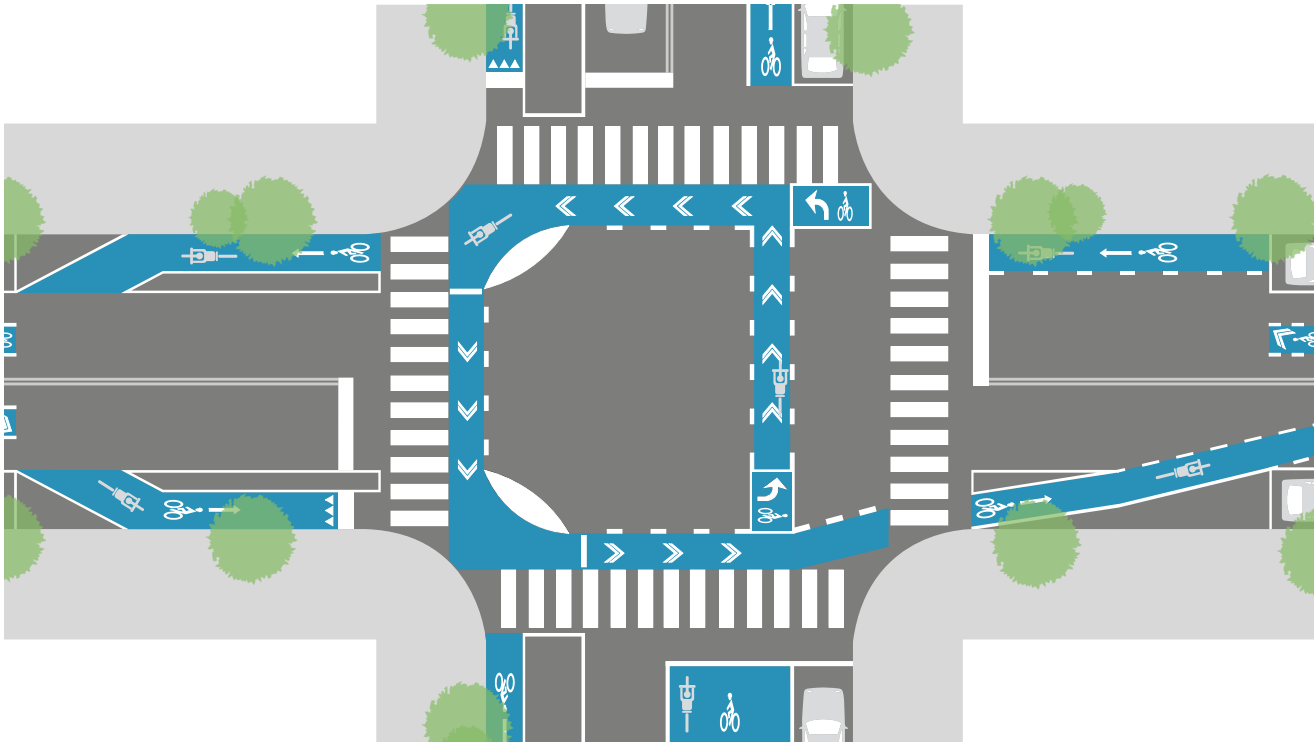
Recommended

- Crossbike markings across vehicle travel lanes
- Green retroreflective bike lanes and crossbike markings
- Leading bicycle/pedestrian interval
- Intersection daylighting
- Bike box
- Two-stage queue box
- Protected bike lane with approach buffer
- Corner safety islands
- Pedestrian refuge islands
- Cyclist crosswalk yield line markings
- Forward stop bar
- “Turning vehicles yield to bikes” signs for drivers

Optional

- Bicycle traffic signal
- Mountable corner safety islands or turning apron
- “Yield to pedestrians” signs for cyclists
- Cyclist yield line markings
- Planters with built-in hand and footrest may be used to add comfort
- Circular / rectangular planter may be used as barrier elements
- Pedestrian refuge islands may integrate bike corrals, plantings and green infrastructure
- Turning vehicle size restrictions

DESIGN DIMENSIONS



DESIGN GUIDANCE

- Traffic volumes may require exclusive turn lanes, signals, and signal phases.
- See Design Notes for or: Corner Safety Island, Protected Pocket Bike Lane (Ingress/Egress), Bike Box, Two-Stage Queue Box, Intersection Daylighting.

Required

- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)
- See Required Design Dimension guidance for: Corner Safety Island, Protected Pocket Lanes (Ingress/Egress), Bike Box, Two-Stage Queue Box, Intersection Daylighting

Recommended

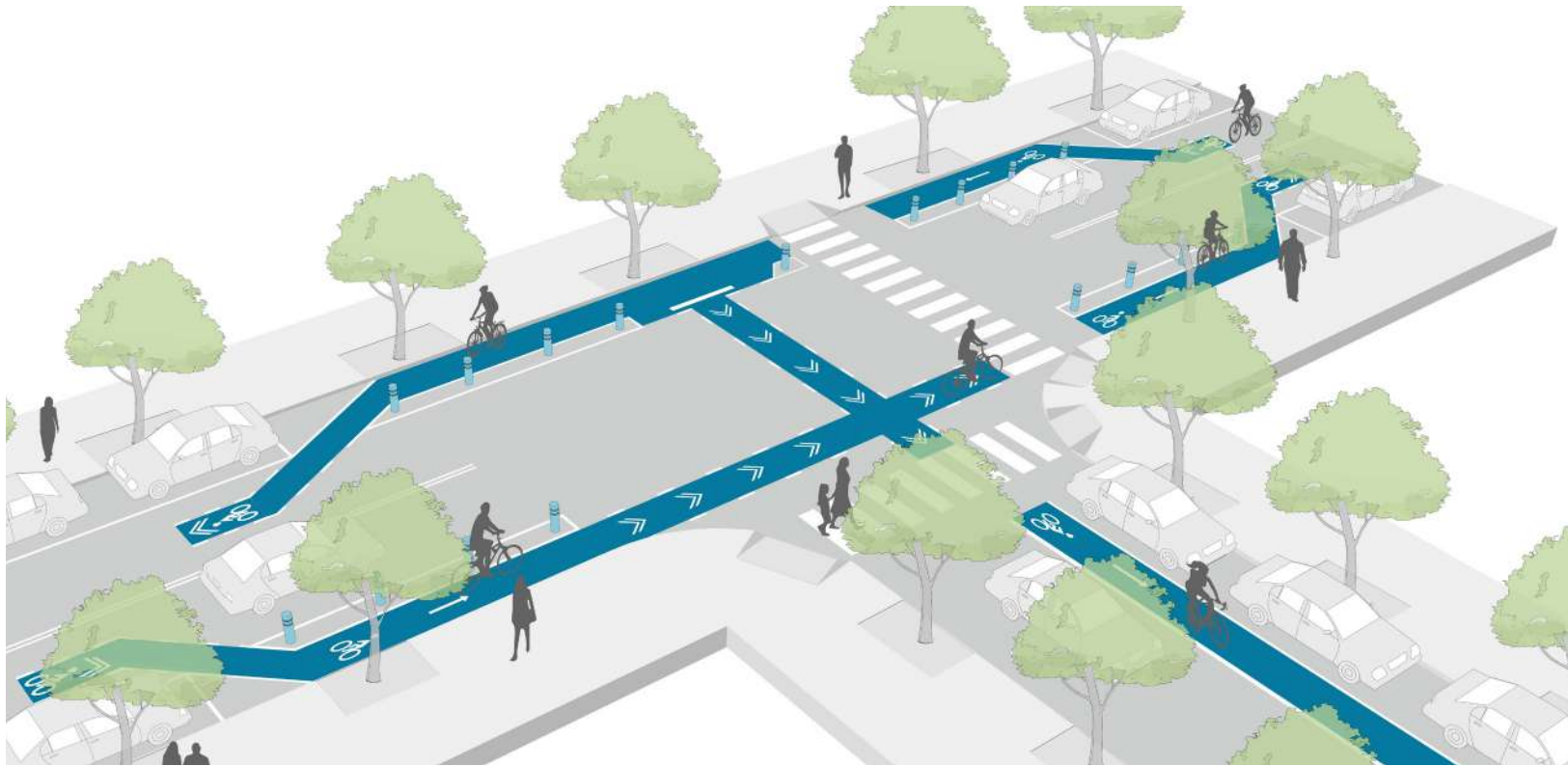
- Minimum 10' depth for bike box; Overall width to match combined adjacent vehicular width and bikeway width
- Bicycle refuge stop bars should be used and be a minimum of 12" in width
- See Recommended Design Dimensions for: Corner Safety Island, Protected Ingress/Egress, Bike Box, Two-Stage Queue Box, Intersection Daylighting

Optional

- See Optional Design Dimension guidance for: Corner Safety Island, Protected Pocket Bike Lane (Ingress/Egress), Bike Box, Two-Stage Queue Box, Intersection Daylighting

3c. T-Intersections

Jersey City's T-intersections are 3-way junctions where one street (typically a minor street) originates or terminates at another intersecting street (typically a major street). T-intersections force all approaching traffic on the minor street to turn, and the minor street can only be accessed from the intersecting major street via a turn. Thus, there is a preponderance of turning movements at T-intersections which can cause conflicts with cyclists that should be given special consideration. T-intersections are common throughout Jersey City where streets terminate at the waterfront, highways and rail lines, or large parks and private parcels, and where there is misalignment in the street grid, such as along Ocean Avenue in the Greenville neighborhood and Central Avenue in The Heights.



APPLICATIONS:

T-intersection bikeway treatments are appropriate at any T-intersection where either the major or the minor street includes any type of bikeway.

BASIC COMPONENTS



T-intersection treatment,
Burlington, VT (Street Plans)

Required

- Standard MUTCD bicycle pavement markings with directional arrows
- Crossbike markings across intersection / vehicle travel lanes
- High-visibility crosswalks at pedestrian crossings
- Protected Pocket Lane (Ingress) at intersection approach on a major street
- Protected Pocket Lane (Egress) at intersection departure on a major street
- Cyclist yield line markings before crosswalks without traffic controls
- Stop bar / queue box for two-stage turns from the “top” of the T intersection

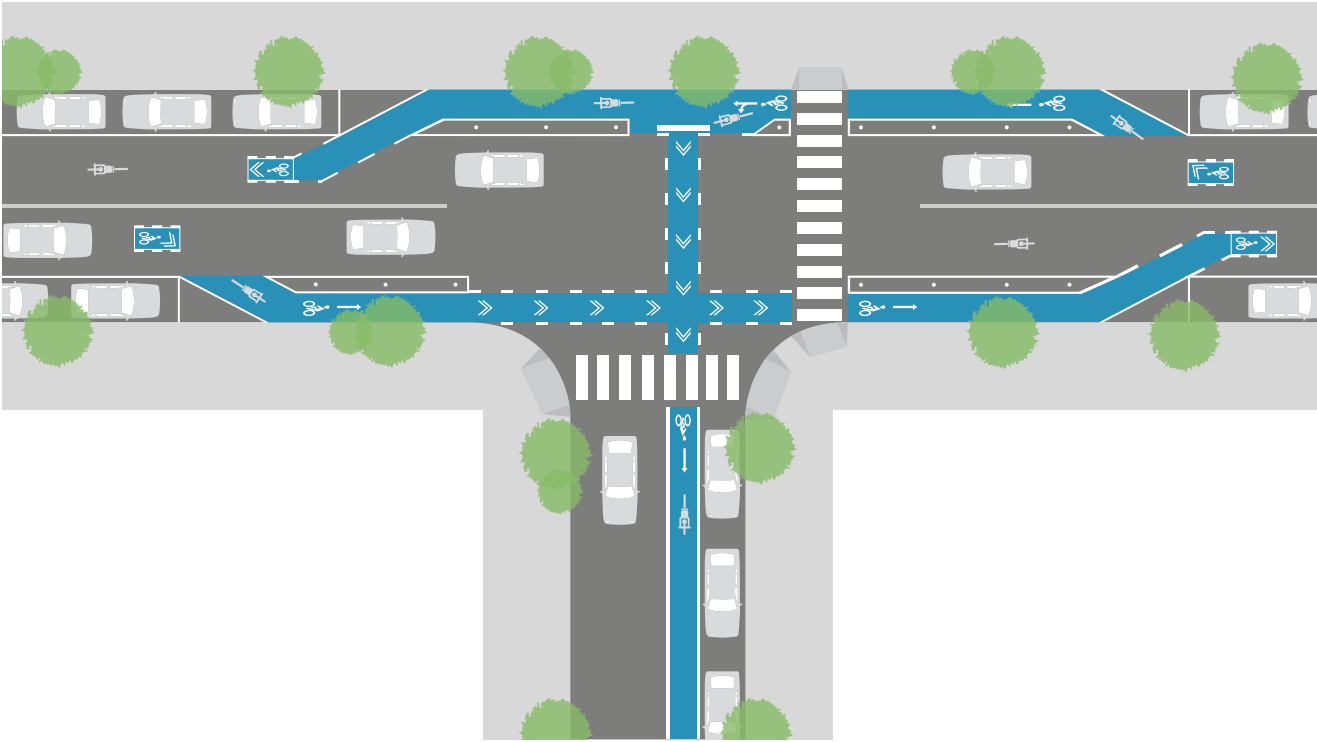
Recommended

- Green retroreflective bike lanes and crossbike markings
- Leading bicycle / pedestrian interval

Optional

- Bicycle traffic signal
- Median refuge island(s)
- Corner safety islands where there are significant / known right turn conflicts, with mountable turning aprons (if necessary)
- “Turning vehicles yield to bikes” signs for drivers
- “Yield to pedestrians” signs for cyclists
- Vehicle size and turn restrictions

DESIGN DIMENSIONS



Required

- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)
 - 2' minimum buffer width
-

Recommended

- Bicycle refuge stop bars be a minimum of 12" in width
-

Optional

- N/A

DESIGN GUIDANCE

- Traffic volumes may require shared or exclusive turn lanes, signals, and signal phases



T-intersection treatment,
Burlington, VT (Street Plans)

3d. Offset Intersections

Offset intersections are junctions where one street (typically a minor street) crosses another street (typically a major street) asymmetrically, requiring a “jog” or “dog leg” movement to continue on the minor street. Because neighborhood greenways utilize local residential streets, cyclists may periodically encounter such intersections which require them to turn briefly onto another (often primary) street before resuming their prior direction. To accommodate these movements, the suggested treatment is to provide a center median turn bay or a curbside protected lane with a queue box for left turns.



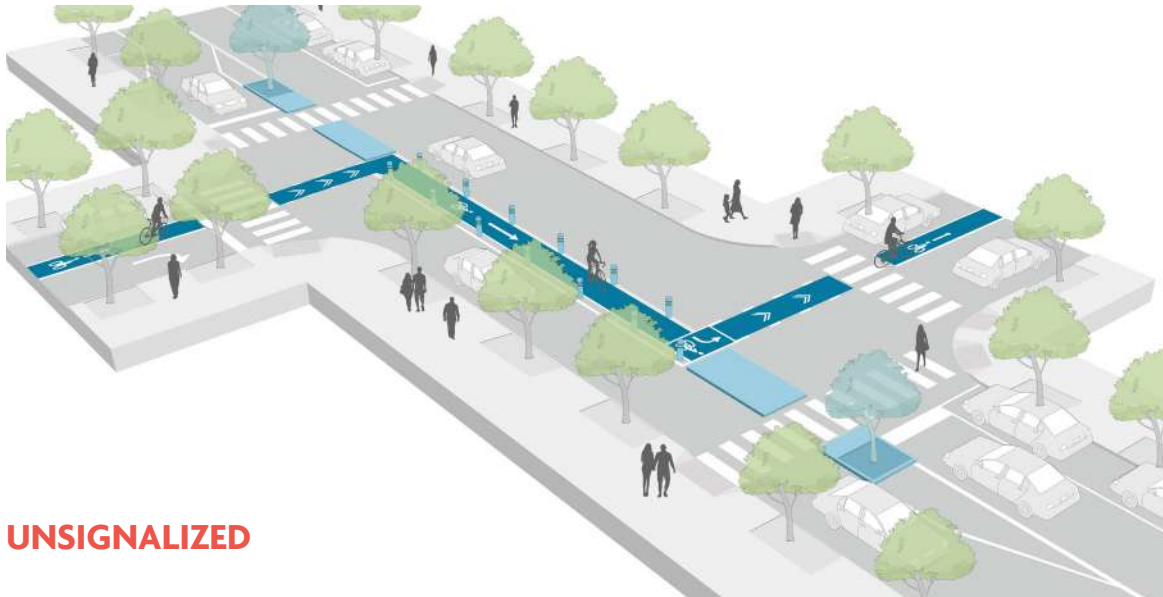
APPLICATIONS:

Offset intersection bikeway treatments are appropriate at any offset intersection where misaligned street right-of-way includes a bikeway of any type.

BASIC COMPONENTS



SIGNALIZED



UNSIGNALIZED

Required

- Standard MUTCD bicycle pavement markings with directional arrows
- Crossbike markings through the intersection, across vehicular travel lanes
- High-visibility crosswalks for pedestrian crossings
- Median cyclist turn bay island along primary streets (unsignalized intersections)
- Curbside protected bike lane on the primary street (signalized intersections)
- Left turn queue box if a left turn is required to continue along the minor street at a signalized intersection
- Cyclist yield line markings before crosswalks without traffic controls
- Stop bar for turns from queue box

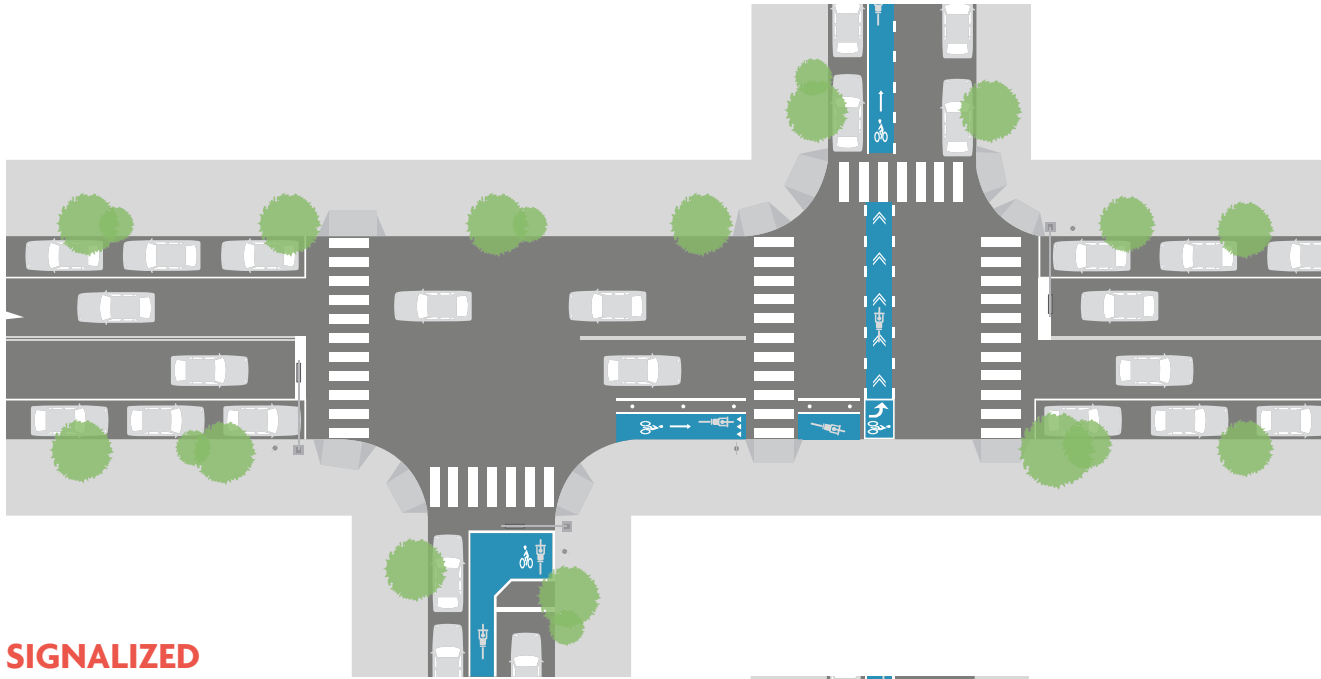
Recommended

- Green retroreflective bike lanes and crossbike markings
- Bike box for turns from the minor street at signalized intersections
- Leading bicycle/pedestrian interval for signalized intersections
- Pedestrian safety island(s)

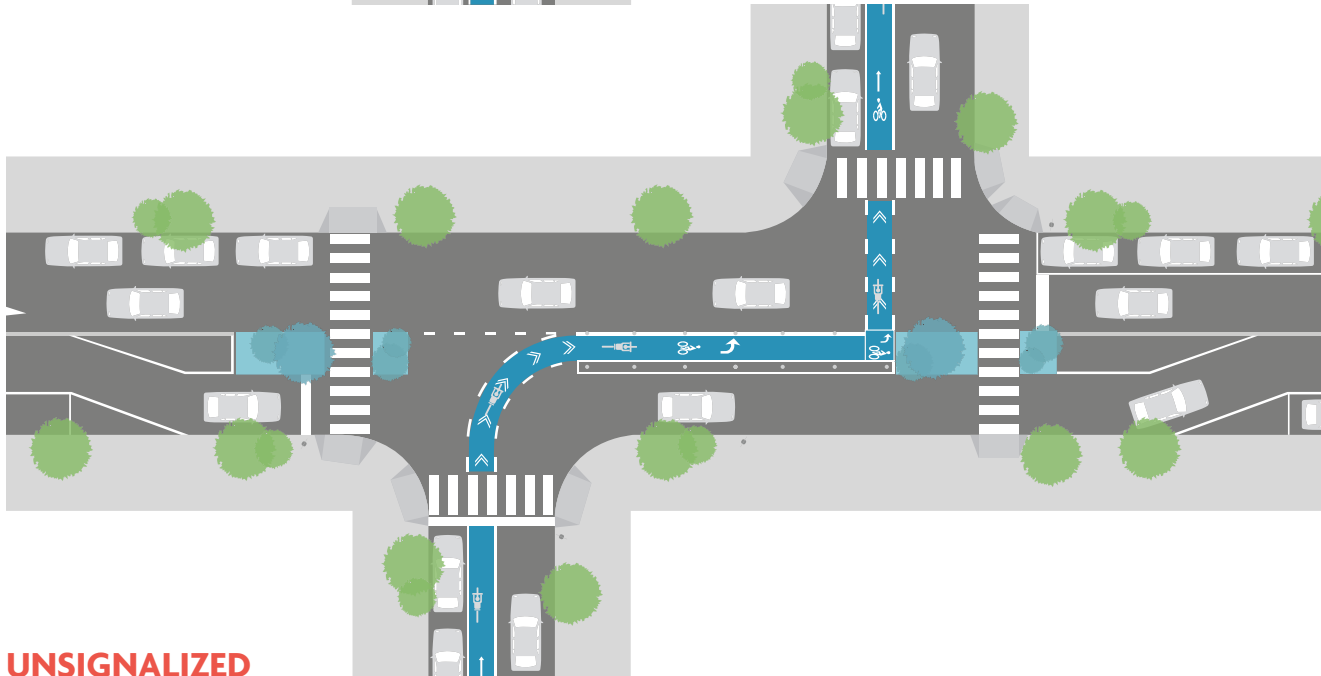
Optional

- Bicycle traffic signal
- Corner safety islands where there are significant right turn conflicts, with mountable turning aprons (if necessary)
- “Turning vehicles yield to bikes” signs for drivers
- “Yield to pedestrians” signs for cyclists
- Cyclist yield line markings
- Vehicle turn and /or size restrictions
- Flush or raised medians/pedestrian safety islands bollards.
- “No Left Turn” with “Except Bicycle” signs may accompany the turn bay or median if vehicular left turns are prohibited.

DESIGN DIMENSIONS



SIGNALIZED



UNSIGNALIZED

Required

- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)

Recommended

- Bicycle refuge stop bars should be a minimum of 12" in width

Optional

- N/A

DESIGN GUIDANCE

Selection of the appropriate treatments depends on the width, traffic volume, and urban design / land use characteristics of the intersecting street, and on whether the neighborhood greenway jogs to the right or to the left. When a bikeway along a minor street crosses a primary thoroughfare at an offset intersection, additional treatments may be required to maintain the safe and attractive look and feel of the bikeway to, through, and beyond the junction.



Offset-intersection treatment,
Burlington, VT (Street Plans)

3e. Driveway Crossings

Curb cuts are informal intersections which interrupt the continuity of sidewalks and bikeways, thereby creating conflicts between various streets users. Although residential and commercial driveways typically have much lower traffic volumes than public streets, they present a special challenge because they have narrow openings with limited sightlines which can be obstructed by building features and parked vehicles. Driveways may have vehicles of many different sizes entering and exiting unpredictably, moving forward or in reverse, without traffic controls.

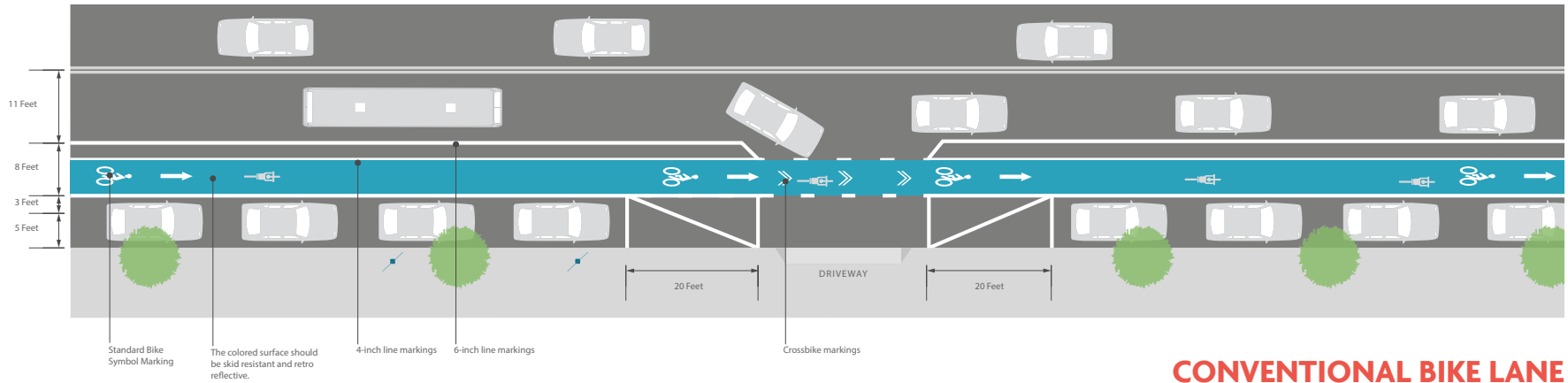


Jay Street driveway crossing
Brooklyn, NY (Street Plans)

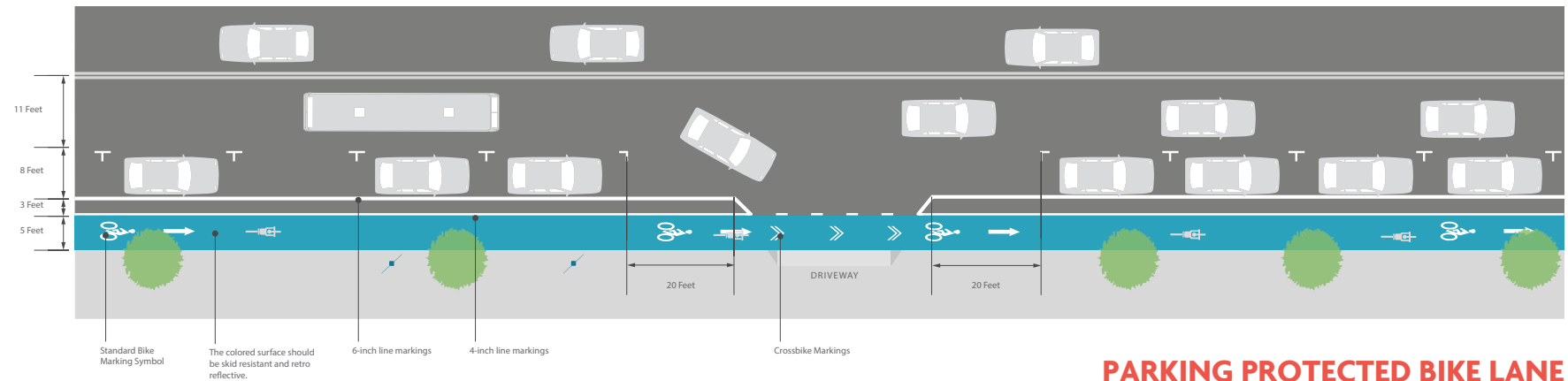
APPLICATIONS:

Every bikeway intersecting a curb cut requires countermeasure treatments which should be based on site-specific conditions. Due to the dangers for people walking and cycling, it is recommended that Jersey City seek to limit the frequency and breadth of curb cuts to every extent possible through the zoning code; unused curb cuts should be closed as properties evolve, access to existing ones should be narrowed to the minimum required width, and new ones should be discouraged or prohibited.

BASIC COMPONENTS



CONVENTIONAL BIKE LANE



PARKING PROTECTED BIKE LANE

Required

- Crossbike markings
- Standard MUTCD bicycle pavement markings with directional arrows
- Intersection and curb cut daylighting treatments

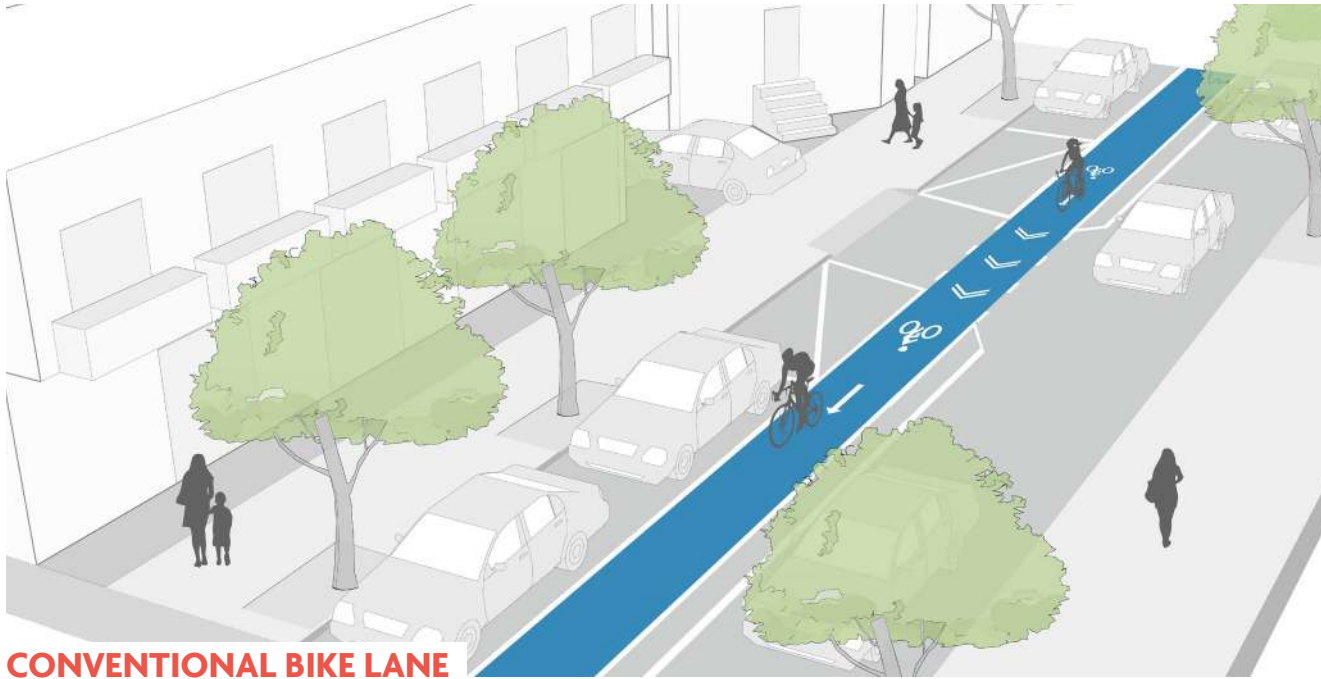
Recommended

- Narrow curb cut access to minimum required width using striping
- Green retroreflective bike lanes and crossbike markings across curb cut width

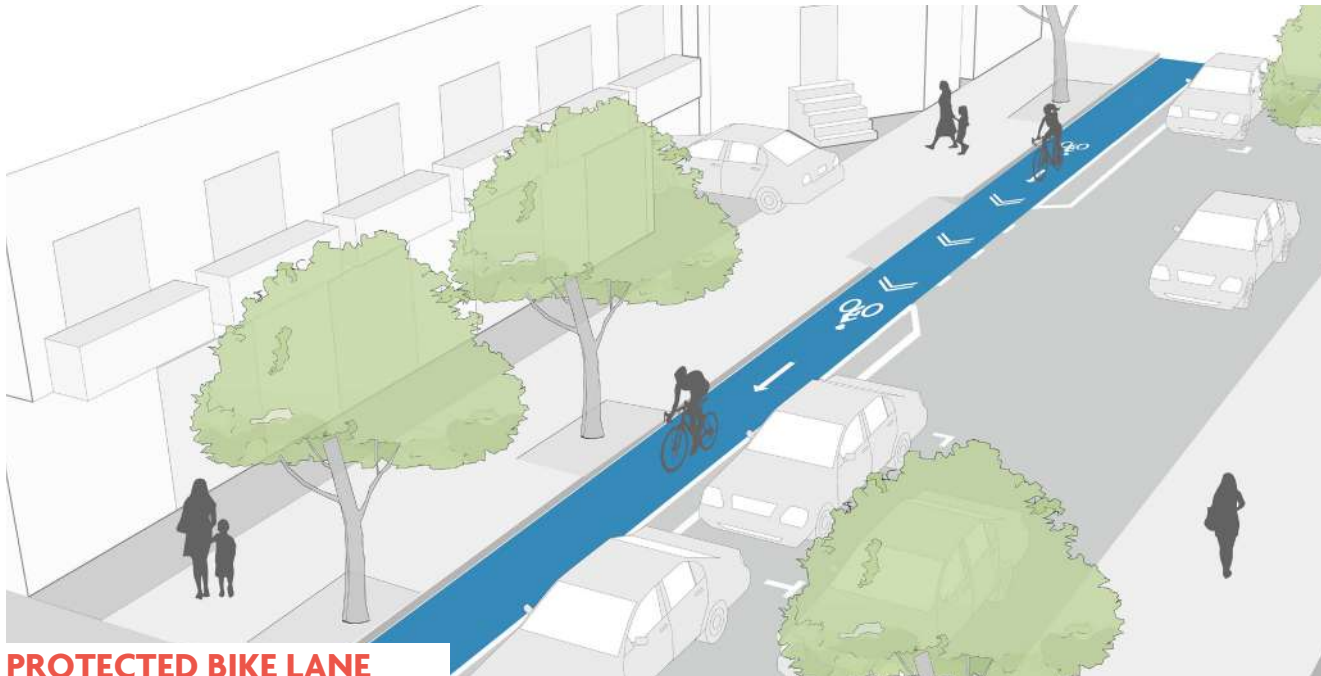
Optional

- “Turning vehicles yield to bikes” signs for drivers
- Flashing red traffic signal at major intersections
- Additional street lighting at major driveway intersections
- Vehicle size and turn restrictions

DESIGN DIMENSIONS



CONVENTIONAL BIKE LANE



PROTECTED BIKE LANE

Required

- 10' minimum clear zone on either side of driveway, 30' for driveways with truck traffic
- 5' minimum bike lane width (6' or greater desired, especially where lanes are intended to accommodate other users such as scooters, skateboards, etc.)
- See Required Design Dimension guidance for: Crossbike markings (88), Intersection Daylighting (104)

Recommended

- 20' clear zone

Optional

- See guidance for: Crossbikes (88), Daylighting (104)

DESIGN GUIDANCE

- No vertical elements other than sign poles and tree trunks should obstruct curb cut visibility between a height of 3' and 10'.
- New street tree plantings should be set back a minimum of 5' from curb cut entrances.
- Traffic volumes may require exclusive turn lanes, signals, and signal phases at large-scale commercial developments.



Protected bike lane and driveway
crossing demonstration project,
Providence, RI (Street Plans)

3f. Rail Crossings

Bikeways intersecting with rail crossings require special treatment to ensure cyclists' safety, as railway tracks have deep and sometimes uneven gaps which bike tires can drop into, causing cyclists to fall and be injured. Bike-friendly rail crossings are applicable wherever a bikeway intersects rail tracks. Bike-friendly trackway design is important for all existing and future bikeway crossings.

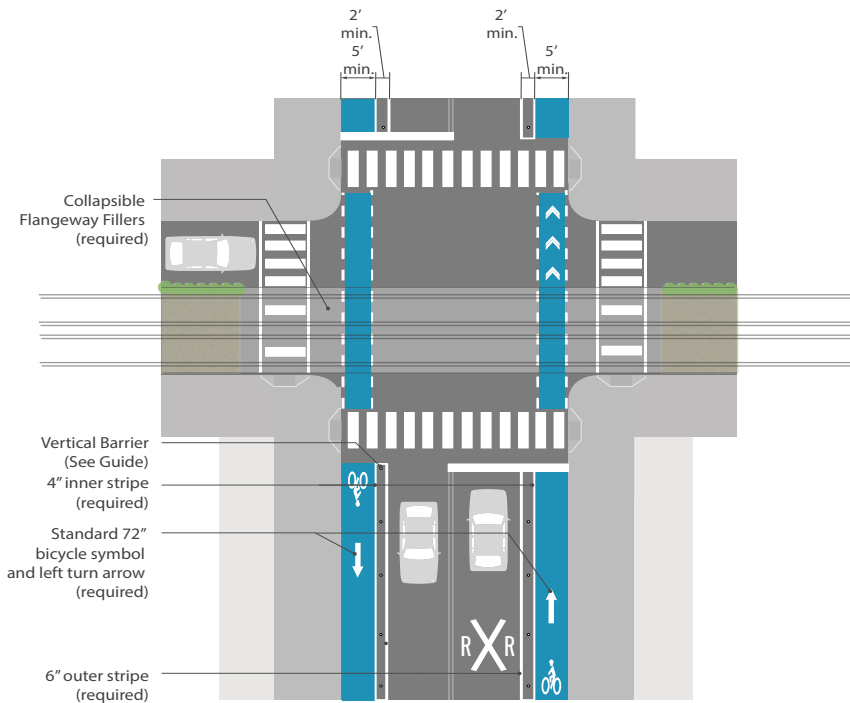


Protected bikeway rail crossing,
Portland, OR (Street Plans)

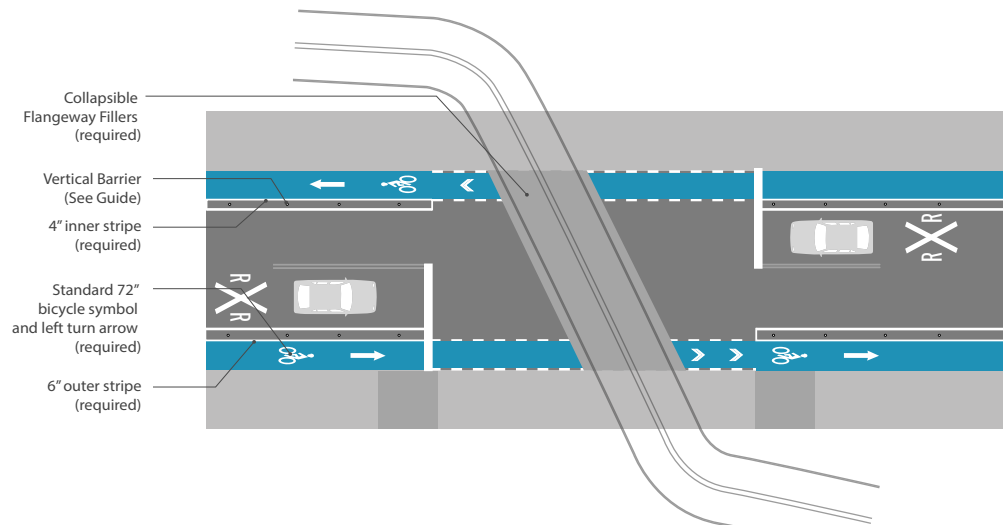
APPLICATIONS:

Every bikeway intersecting a curb cut requires countermeasure treatments which should be based on site-specific conditions. Due to the dangers for people walking and cycling, it is recommended that Jersey City seek to limit the frequency and breadth of curb cuts to every extent possible through the zoning code; unused curb cuts should be closed as properties evolve, access to existing ones should be narrowed to the minimum required width, and new ones should be discouraged or prohibited.

DESIGN DIMENSIONS



PROTECTED BIKE LANE INTERSECTING RAILWAY CROSSING



PROTECTED BIKE LANE INTERSECTING RAILWAY CROSSING

Required

- Standard MUTCD at-grade railroad crossing controls (signage, signals, and gate arms)
- Standard MUTCD bicycle pavement markings with directional arrows
- MUTCD warning signage ahead of the intersection with the railway (see page 134 - Signage chapter)
- Any rail crossing bikeway design should follow the standards of NJ Transit and NJDOT
- Bikeway design must guide people cycling to cross tracks at a 60-90 degree angle, ideally on a straightaway as opposed to a curved approach

Recommended

- Flangeway filler strips to prevent wheels from getting caught between the rail track and pavement seams

Optional

- Bicycle signal at select intersections bisected by rail transit
- Separate gate arm for off-street paths

SIGNAGE + INFORMATION

1. BIKEWAY TRAFFIC CONTROL SIGNS	136
2. BICYCLE WAYFINDING SIGNS	144
3. INFORMATION SIGNS	148

There is a wide variety of standard street signs specifically designed to make street users aware of the presence of a bicycle facility, to communicate warnings and regulations, and to help with orientation and wayfinding.

When sign information is directed towards people driving or actively cycling in the street, they tend to conform to Manual on Uniform Traffic Control Devices (MUTCD), FHWA's design standards. When the messages are directed towards people walking or stopped cyclists in protected or off-street areas (e.g. maps and information signs), there are generally more opportunities for customization and allowance for designs that are not confined to the highway-style sign vernacular.

This chapter includes examples and guidance for signs divided into five primary categories: regulatory signs, routing and wayfinding signs, advisory and warning signs, temporary signs, and information signs. This is not an exhaustive inventory of all the bicycle facility signage covered in MUTCD, but a selection of signs that are bicycle-specific or of particular relevance or utility to the implementation of the Jersey City Bicycle Master Plan. In many cases, the designs shown are effectively templates that may be adjusted using site conditions, design preferences, and engineering judgment. Using the MUTCD templates for colors, shapes, lines, and sizes, almost any custom message can be created, however, it is generally recommended that planners and engineers choose the most relevant common or existing sign designs whenever possible as they will be more familiar. The signs may appear alone or in combination depending on the circumstances and based on the signage plan for a given street, route, or intersection.



1. BIKEWAY TRAFFIC CONTROL SIGNS



To compliment vehicle traffic control signs, there is a suite of signs designed specifically for bikeways as well as general use signs which have special significance when placed along a bikeway. Bicycle traffic control signs should be retroreflective, mounted at least 8 feet high on poles, and be as close as possible to bicycle facilities (not more than 2 feet away from the curb). Each individual sign should have a uniform size and consistent placement throughout Jersey City. For further guidance, refer to MUTCD Chapter 9.

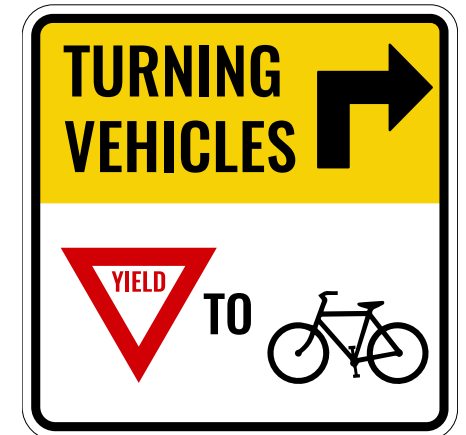
Regulatory sign, Miami, FL
(Street Plans)



Bike lane regulatory sign,
Rogers, Arkansas (Street Plans)

1a. Bikeway Regulatory Signage

Bike facility regulatory signs (typically black on white) are used mainly to alert drivers and cyclists to the presence of a dedicated bicycle facility such as an unprotected lane, shared lane, protected on-street lane, or off-street path. These signs are important for traffic enforcement purposes as they communicate the traffic rules specifically pertaining to bicycle facilities. They can also be useful for navigation and orientation purposes, and also reinforce painted lanes in situations where markings may be obscured due to traffic, obstacles, faded paint, or snow. These signs are generally the size of common traffic signs and feature similar reflectivity so they can be read by people driving at night or in otherwise low-visibility weather conditions.



Some of these signs may be directed at cyclists and are meant to **communicate certain behaviors or operations specific to bicycle facilities**. This include which signals to use, how and when to pass, or how to interact with pedestrians. These signs are generally smaller in size and are placed closer to eye-level alongside or very near to the bikeway. Their use is common as a response to observed issues or in cases where complex interactions may warrant detailed instructions.



There are also **parking regulation signs** to designate or reinforce parking rules for cars and to communicate bicycle parking information to cyclists. When it comes to parking signs, red colors are generally used for negative messaging and green for positive messaging.



R13-17 Bike Lane Signs

The BIKE LANE (R3-17) sign spacing should be determined by engineering judgment based on the prevailing speed of the bicycle and other traffic, block length, distances from adjacent intersections, and other considerations. Bike lane designation signs are recommended at the start of every bicycle facility, facing the direction of approaching traffic, and recurring at least every 800-1000 feet. They are also recommended immediately following all intersections with high volumes of vehicular traffic and intersections that feed through traffic such as State/County roads, offramps, and truck or bus routes. They may be placed along every city block with a dedicated bicycle facility, immediately following each intersection, facing the direction of approaching traffic as close as possible to the intersection.

The AHEAD (R3-17a) sign (see Figure 9B-2) should be mounted directly below an R3-17 sign in advance of the beginning of a marked bicycle lane.

The ENDS (R3-17b) sign (see Figure 9B-2) should be mounted directly below an R3-17 sign at the end of a marked bicycle lane.

R4-11 Bicycles May Use Full Lane Sign

This sign is recommended for all streets with shared lanes for through movements (as opposed to shared turn lanes) including neighborhood greenways. It is optional on streets where there is not sufficient lane width or shoulder space for cycling without occupying a lane of traffic and recommended at any location where it is important to inform street users that bicyclists might occupy the travel lane.

R5-3 No Motor Vehicles Sign

This is an optional sign for off-street paths, trails, and pedestrian streets where vehicles are prohibited. Placement is recommended near intersections with motor vehicle traffic.

Turning Vehicles Yield to Bikes Sign

This sign is a custom variant of the MUTCD R10-15 (Turning Vehicles Yield To Peds) sign. It is recommended for all intersections where drivers have to cross a bike facility where cyclists are traveling in the same direction as motor vehicles in order to make a turn (e.g. a right turn across a right-side bike lane on a two-way street), especially when crossing protected bikeways which are spaced further apart from vehicle travel lanes than unprotected lanes. Placement is recommended in the line of sight where drivers preparing to turn will see it as they approach the intersection, such

as a pole immediately on the near or far side of the intersection along the street onto which they are turning.

Bicycle Regulatory Signs (R9-5 and R9-6)

The R9-5 sign may be used where the crossing of a street by bicyclists is controlled by pedestrian signal indications. The R9-5 sign should be installed near the edge of the sidewalk in the vicinity of where bicyclists will be crossing the street. The R9-6 sign may be used where a bicyclist is required to cross or share a facility used by pedestrians and is required to yield to pedestrians. The 9-10 and R-22 signs are examples of signs that can be used to direct cyclists on how to use actuated signals and detectors (where applicable).

Bicycle Path Signs (R4-1, R4-2, R4-3, R4-16, R9-7)

These signs are used to communicate to cyclists positioning on bikeways. This can help with maintaining safe separation from other path users and give instructions for safe riding and overtaking movements. These signs are most important on shared use paths, high volume bikeways (especially two-way), and situations where there are many users at varying speeds and levels of experience, or where overtaking movements may result in cyclists entering into conflicts with vehicles, pedestrians, or oncoming cyclists.

Bike Lane Parking Signs (R7-9)

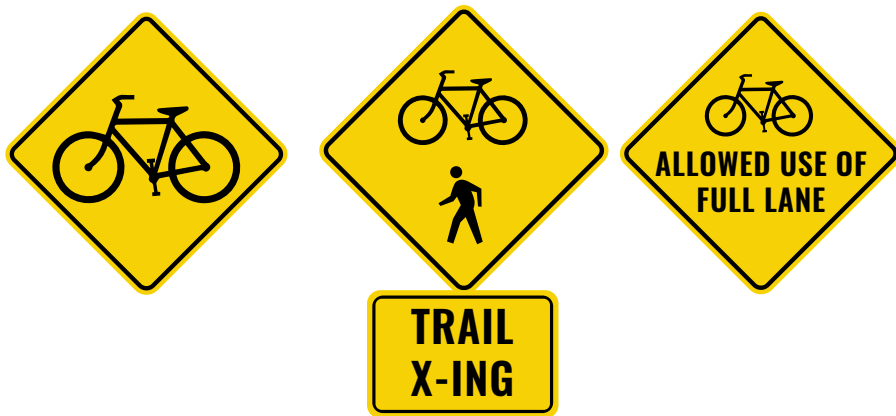
These signs reinforce city regulations regarding prohibitions on vehicles parking in bike lanes. They are recommended for streets with curbside bicycle lanes where vehicle parking is prohibited or any areas where there are observed problems with vehicles illegally parking in bicycle lanes.

Bike Parking Signs

Bike parking signs direct cyclists to areas where they can find places to park bikes such as bike corrals, bike lockers, and bike parking lots. See the Bicycle Parking chapter for more information.

1b. Warning + Advisory Signs

Warning and advisory signs for bikeways are generally yellow diamonds with black borders, with information that may be directed towards drivers, cyclists, or all road users.

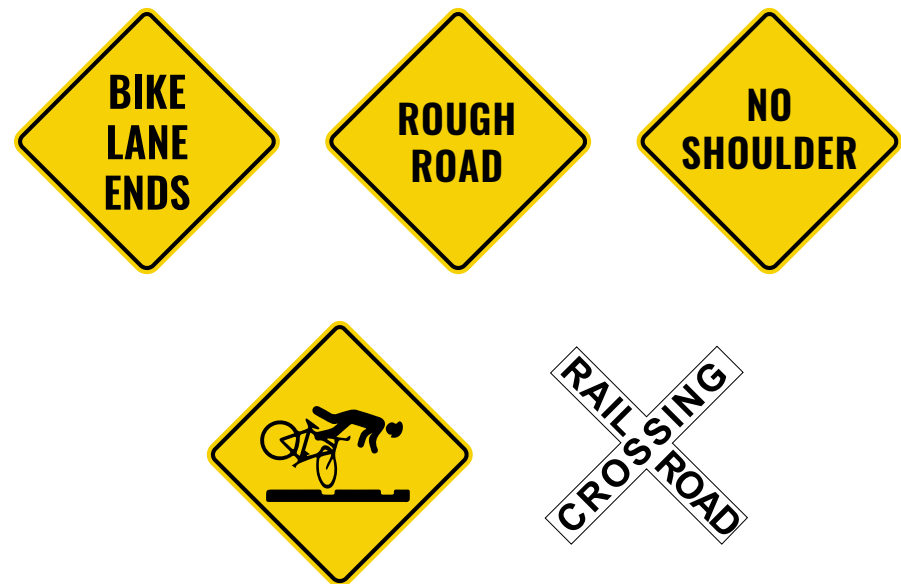


Bicycle Warning Signs (W11-1 and W11-15)

These are optional signs to alert drivers to the presence of cyclists in the street right-of-way. These are recommended for locations where drivers transition from an area with few or no cyclists such as a highway to an area with bike facilities. They are also useful for locations with crossings and conflicts such as when a trail or off-street path intersects a roadway and locations where there have been crashes or are known issues.

Road Hazard Signs (W8-8, W8-23, R15-1)

These signs alert cyclists to significant changes to bicycle facilities and street conditions which may present hazards. Specific signs warn cyclists of dangers related to railroad crossings and gaps between tracks. They are recommended wherever such hazards exist or where there are known issues.



1c. Temporary + Construction Signs

Orange signs are used to warn cyclists about temporary changes to bike facilities and street operations as well as possible hazards related to construction activity. When specific to cyclists, these signs should generally include a bicycle symbol so it is clear that cyclists must pay special attention to them. These signs should be used whenever there is construction activity in a bike facility that results in routing changes, facility changes, or hazards, including by companies servicing utilities and as a standard part of traffic maintenance plans for building construction. The configuration of temporary traffic control zones should be informed by the guidance in chapter 5G of MUTCD. It is recommended that bicycle facilities be maintained uninterrupted as much as possible and that the safe movement of pedestrians and bicycles through work zones is prioritized over vehicles in all instances.





Temporary construction facility and
detour signs, Portland, OR
(Michael Andersen/Bike Portland)

2. BICYCLE WAYFINDING SIGNS

Wayfinding signage provides directions to routes, landmarks, destinations, and points of interest. Wayfinding is a critical component of an urban bike network because it helps cyclists find the safest and most direct paths to their destinations rather than getting lost or cycling onto unexpectedly dangerous streets. It also prevents the need for stopping or pulling over to check paper or smartphone apps. A well-designed bicycle wayfinding system includes consistent, highly visible signs along all major routes and at key decision points, making the network easily navigable even for novice cyclists who are not very familiar with the city. Creating a full bicycle wayfinding program is not part of the scope of this plan, but it is recommended that Jersey City make this a priority component of the rollout of the bicycle network.

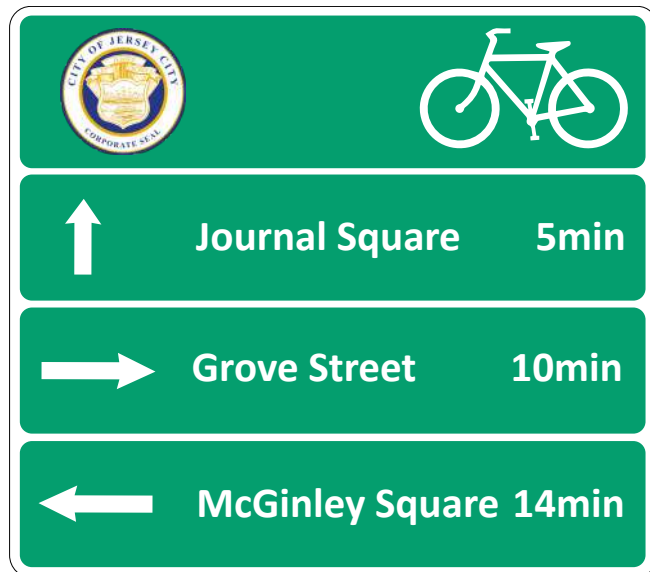


Wayfinding Signs, Boulder, CO
(Street Plans)

SIGN DESIGN

The signs which comprise a wayfinding system can be organized into three different categories: **decision point signs, direction signs, and destination signs**. Decision point signs are generally placed at major intersections and point the way to multiple different chosen destinations which may be located in different directions. Direction signs indicate points along the way where cyclists may have to turn to get to a given destination, or simply to reinforce that they should continue in a forward direction. Destination signs inform cyclists that they have arrived at a given destination - something that is important to communicate so that people do not pass the destination.

The MUTCD standard design for wayfinding is green with a white border and use the Clearview Hwy font just like highway signs. Follow MUTCD standards (Section 9B.01 – Application and Placement of Signs), including mounting height and lateral placement from the edge of the path or roadway. Additional standards and guidance are found in Section 9B.20 – Bicycle Guide Signs.



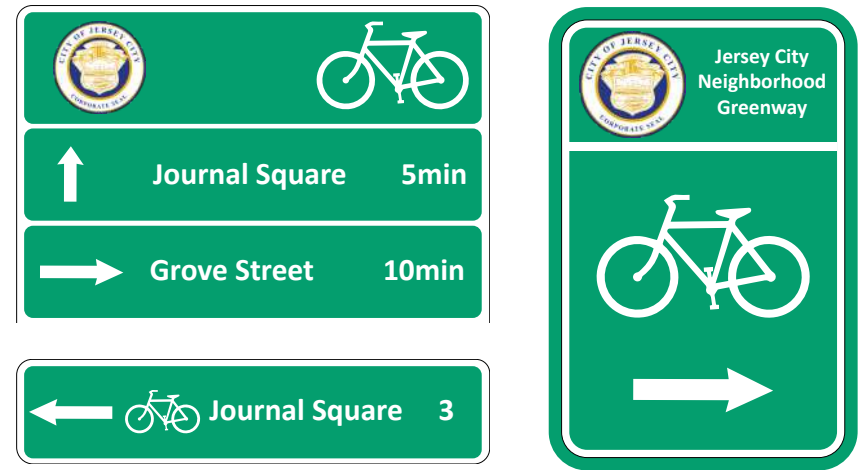
Decision Point Signs

Decision point signs should be placed in advance of the intersection of all major bikeways or decision points along bikeways and direct cyclists to key destinations. Decision signs should include destination names, directional arrows, and distance in miles. Travel time required to reach the destination provides bicyclists with additional information and may also be included using 10mph to calculate the travel time.

Ideally, there should not be more than four or five destinations on one sign. Place the closest destination to each sign at the top. Destinations that are further away can be placed lower down. In this way, as cyclists approach a destination, it moves up higher and higher on the signs. For longer routes, you can show local destinations rather than include all destinations on a single sign. The placement of wayfinding signs may be limited specifically to the designated bicycle network, as other streets may be difficult or dangerous for cyclists.

Direction Signs

Direction signs tell cyclists that they need to turn to get to a destination. They can also tell cyclists to continue straight as a way to reinforce that they are going in the right direction if there hasn't been a decision point sign for a while. Like decision signs, direction signs should be placed on the near-side of intersections where cyclists are directed to turn. Straight ahead signs (which may or may not include an arrow) can be placed at any point along the route and are recommended to be located in high visibility areas and/or at intersections. Direction signs that reinforce continuing straight should be placed every 0.25 - 0.5 miles or every 2 to 3 blocks.



Destination Signs

Destination signs may be used to let cyclists know that they have arrived at a destination. This is especially useful for destinations that are along a continuing bikeway where cyclists might accidentally pass them by, as opposed to a terminal or an obvious feature such as a waterfront park or a bridge.





3. INFORMATION SIGNS



Temporary network information sign,
New Orleans, LA (Street Plans)

Information signs are optional temporary or permanent signs which can provide messages designed to educate or orient citizens. There is no universal standard for the design of information signs but they can incorporate elements of MUTCD signage such as border lines, bicycle symbols, and Clearview font. Some examples include printed bike map signs and instructions for vehicles, cyclists, or pedestrians on how to use bicycle facilities. Maps can be placed periodically along bike routes to compliment wayfinding systems, providing additional opportunity for orientation and decision-making. Signed bicycle routes and maps may be partnered with printed or online bicycle network maps. Many online services, such as Google, now offer bicycle route mapping that may differ from signed routes. Cities may wish to consider such advancements in technology when planning wayfinding and information sign programs.

APPLICATIONS:

Information signs should be placed at stopping points and off-street path locations where there is an opportunity to pause and read a message, possibly by dismounting. They are useful at places where there are distinctive facilities such as gateways and trailheads, or sites where new infrastructure types are installed, such as Neighborhood Greenway features, bike boxes, corner safety islands etc. Maps should be placed at trip origin/destination points, such as a transit station, and major decision points, like the confluence of two protected bikeway network links.

DESIGN GUIDANCE

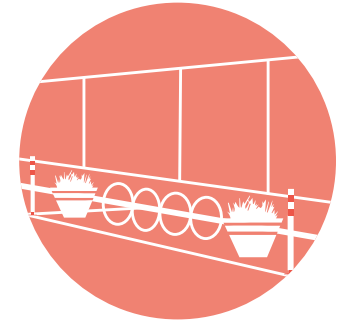


- Signs adjacent to bikeways should be installed at a height of 8'. Off-path signs can be installed at eye-level, which is preferential for maps.
- Signs which communicate information to cyclists and motorists in moving lanes of traffic should generally conform to the MUTCD vernacular.
- Larger title panels may be used to draw cyclists to off-path locations where smaller, detailed information is provided on a separate panel.
- Information signs may be combined with other signs such as wayfinding and regulatory signs.
- It is generally discouraged to combine information signs with traffic control or warning signs.
- Signs that communicate similar information such as elements of bicycle infrastructure programs (e.g. Neighborhood Greenways) should have a unified design with consistent branding and graphic elements citywide.

BICYCLE PARKING

1. SHORT-TERM BIKE PARKING	152
2. LONG-TERM BIKE PARKING	160
3. TEMPORARY BIKE PARKING	164
4. BIKE PARKING SIGNAGE	165

Bikeways are the most visible element within a bicycle network, but cyclists must also have safe and convenient places to store their bicycles. Providing bicycle parking and other “end-of-trip” facilities are critically important to supporting cycling as a viable mode of transportation.



Solutions range from the basic bicycle rack to semi-enclosed bicycle shelters, to full bicycle “stations” that may offer bicycle storage and repair facilities, showers, lockers, changing rooms, rentals, and even café/social gathering spaces. No matter the type, bicycle parking is commonly excluded or insufficiently addressed in the planning, urban design, and urban development process. As a result, accessible, attractive, and safe parking options for both short and long-term use are often under- or oversupply, and poorly sited.

No matter the type or location, bike racks should support a variety of bike types in an upright position and offer at least two points of contact, allowing users to secure the frame and one wheel with a typical U-lock. Ideal forms of bike racks include inverted ‘U,’ circle, and post-and-ring typologies. In contrast, bike rack forms not recommended include ‘wave,’ single post, spiral, and ‘comb’ designs. These styles do not support a variety of bike types, do not allow two-point locking of bikes, do not park bikes efficiently, and are generally cumbersome to use. Generally, bike racks should be 30-38 inches in height and 20-30 inches wide to provide sufficient support and points of contact for most bike types.

While countless bicycle parking designs and configurations exist, there are only two basic types: short- and long-term bicycle parking. These two types include six basic sub-types. Short-term parking facilities consist of individual or clustered bicycle racks, on-street bicycle corrals, and bicycle shelters. Long-term parking facilities include fully enclosed bicycle lockers and fully enclosed bicycle stations/storage rooms.

Matching each of these types and the available configurations to the right context is not difficult, but requires an understanding of the following:

- The intended bicycle user group
- Length for which bicycles are likely to be parked
- Type(s) of trips to be accommodated (long/short term)
- The proposed location and the existing/future land use
- Urban design characteristics

1. SHORT-TERM BIKE PARKING



Unsecured bike parking includes outdoor racks where cyclists may lock their bikes with their own locks for a limited period of time. This is the most common kind of parking and represents the minimum accommodation that should be available on all streets throughout the city regardless of nearby network density or cyclist volumes. Failure to provide at least modest amounts of unsecured parking will result in improvised locking to gates, fences, poles, trees, street furniture, and private property. Unsecured bike parking does not have any attendants, surveillance, or security controls but nonetheless provides a crucial end-of-trip amenity that many neighborhoods lack.

Temporary Ward Tour bike parking,
Jersey City, NJ (Street Plans)



1a. Bike Racks

Outdoor, short-term bike parking, usually surface-mounted or embedded in the ‘furniture’ zone of sidewalks. Users secure bikes with personal locks. If sited correctly, each bike rack should accommodate 2 bicycles.

APPLICATIONS:

Single bike racks are typically installed at intervals along commercial streets where demand is intermittent. Due to their small profile, single bike racks can be located where larger bike parking facilities are not feasible, often installed in the ‘furniture’ zone of sidewalks, alternating with planters/street trees, lighting, bus stops, and seating. Unless the sidewalk is very generous in width (15’ or greater) standalone bike racks should be positioned parallel to the street. In all instances, bike racks should be buffered from the pedestrian zone of the sidewalk to maintain clear and ADA-compliant circulation.



Standard rack, Jersey City, NJ
(Noa Younse)

DESIGN GUIDANCE

- Single bike racks should be placed in visible locations to maximize user security and minimize potential theft
- Sufficient lighting should also be prioritized for night-time use.
- Placing bike racks adjacent to active building frontages and other destinations areas increases their usefulness and security; unless the sidewalk is wide (15’ or greater), orient bicycle racks parallel to street/building frontage.
- When located on sidewalks, single bike racks should have a minimum buffer of 24 inches to the curb and should be placed between on-street parking stalls to avoid conflict with car doors.
- To create multi-racks, a minimum of 36 inches buffer should be kept between each individual bike rack to allow easy use.
- Bike racks should support a variety of bike types in an upright position and offer at least two points of contact, allowing users to secure the frame and one wheel with a typical U-lock. This performance measure is especially important for any public art that doubles as short-term bicycle parking.
- Signs that communicate similar information such as elements of bicycle infrastructure programs (e.g. Neighborhood Greenways) should have a unified design with consistent branding and graphic elements citywide.



1b. Bike Corrals

Bike corrals are comprised of multiple short-term bike racks that are typically located on-street, within one curbside vehicular parking space. Bike corrals usually accommodate 8 - 20 bicycle parking spaces and may also be installed adjacent to intersections, within daylighting zones or wide bikeway buffers, pedestrian safety islands, and street medians. Bike corrals help reduce haphazard or oversubscribed sidewalk bike parking that often interferes with pedestrian access on narrower sidewalks. Increased bike parking has been shown to have positive impacts on adjacent retail businesses, who benefit from increased activity and customer convenience. Users secure bikes with personal locks.



Bike Corral with ground mural,
San Francisco, CA (SFMTA)

APPLICATIONS:

Bike corrals are appropriate for all streets with vehicle parking. They are recommended for commercial corridors, especially the intersection of two commercial streets, and near heavily-used building entrances. Bike corrals are also recommended at any intersection of two bikeways.

BASIC COMPONENTS



DESIGN GUIDANCE

- Standard inverted-u racks (anchored in asphalt or on rails) or custom art racks may be used so long as the rack element is capable of supporting the bicycle frame with two points of contact.
- Site conditions, parking layout, demand, and various applications may dictate different corral size requirements.
- All bicycle parking should be placed so correctly parked bikes do not encroach on the adjacent bicycle or vehicular travel lanes.
- Street murals may be used to add character, increase visibility and support neighborhood aesthetics, as desired.

Required

- Standard MUTCD bikeway pavement marking
- Retroreflective striping demarcating the inside and outside stripe of the bicycle lane
- Crossbike markings (see page 88) in merge area

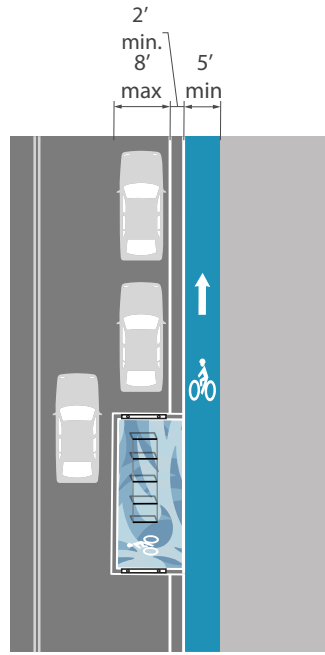
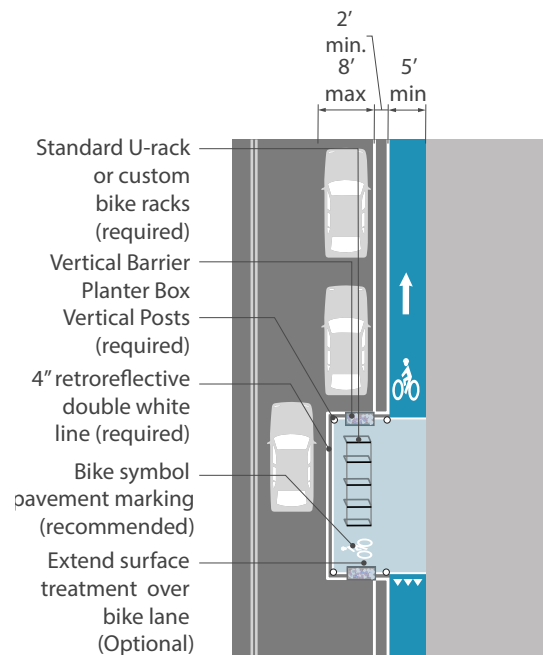
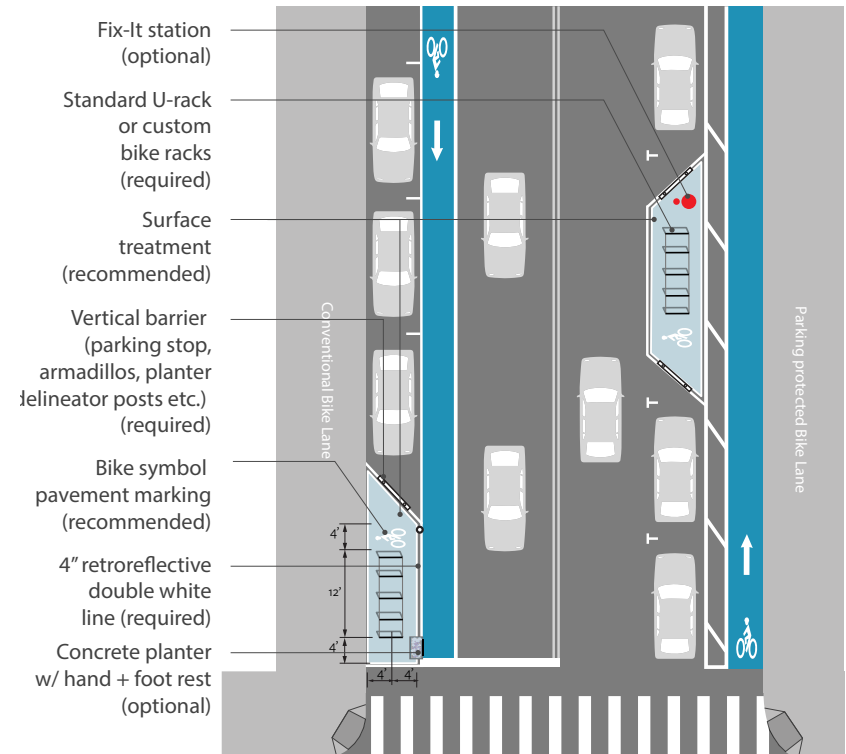
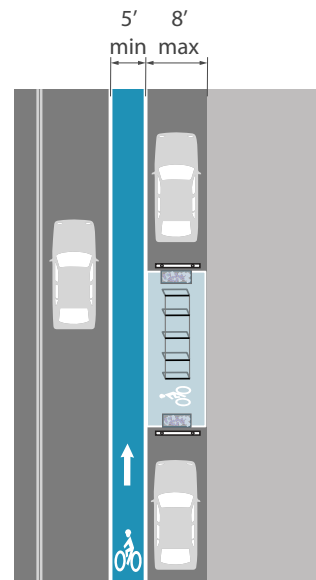
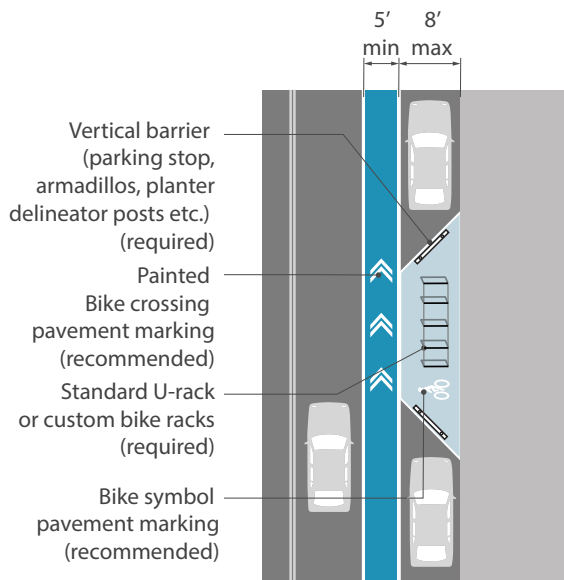
Recommended

- Surface treatment
- Mini-bike pavement marking

Optional

- Fix-it-station (pump, repair tools etc.)
- Adjacent bicycle lane yield line parallel with corral entry
- Site visibility triangle zone corrals may be paired with painted curb extensions to create an interim pedestrian safety island
- Planter with built-in hand and footrest
- Green retroreflective corral ingress marking

DESIGN DIMENSIONS



Required

- Typical bicycle corrals shall be 20' x 8' per corral
- A 4" double retroreflective stripes shall be used to demarcate the bicycle corral area
- A 4' clear zone shall be provided between on-street vehicular parking space(s) and rack, and between the crosswalk and first rack (when placed within site triangle visibility zone).

1c. Covered Bike Parking/Shelters

Outdoor bike shelters provide short- to medium-term bike parking, usually surface-mounted or embedded either in the 'furniture' zone of sidewalks or in offset locations. Shelters may accommodate anywhere from 8 - 50 bicycles (or more!) and offer some level of weather protection. Users secure bikes with personal locks.



Covered parking,
(City of Cambridge)



Covered parking, Portland, OR
(NACTO)



Bike Hangar (Cyclehoop)

APPLICATIONS:

Sheltered bike racks are typically installed along wide commercial streets and at transit stops, where there is medium to high demand. Bike shelters can be installed in the 'furniture' zone of sidewalks or, alternatively, can be located in other locations removed from the street edge or public right-of-way. When located on sidewalks, bike shelters are typically positioned parallel to the street. When placed in other locations, shelters can be oriented in a number of ways but should be positioned to maximize ease of access to streets.

DESIGN GUIDANCE

- Bike shelters should be placed in visible locations to maximize user security and minimize potential theft.
- Sufficient lighting, which would ideally be combined with the shelter itself, should also be prioritized for nighttime use.
- Placing bike shelters adjacent to active building frontages and other areas increases their usefulness and security.
- When located on sidewalks, shelters should have a minimum buffer of 24 inches to the curb and should avoid being placed directly adjacent to on-street parking stalls to avoid conflict with car doors.
- Shelter structures should, at a minimum, provide adequate roof coverage to protect bikes from rain and snow.
- If needed, further enclosures for wind protection may be added.
- Bike shelters can accommodate multi-bike racks or, for higher demand areas, two-tier racks.

2. LONG-TERM BIKE PARKING

2a. Bike Lockers

Outdoor, long-term bike parking, usually surface-mounted or weighted in the ‘furniture’ zone of sidewalks or in offset locations. Typically provide weather protection and are accessed through an individualized key or digital keycode. Often these are available through a rental or permit system. Each unit typically accommodates 1-2 bicycles.

APPLICATIONS:

Single bike lockers are typically installed at parking garages/park n’ rides, transit stations, and large institutions (city hall, hospitals, university, etc.) where there is intermittent demand for overnight / long-term storage. Lockers provide users individualized secure storage for extended periods of time. Bike lockers can be installed in the ‘furniture’ zone of sidewalks or, more commonly, are located in other locations removed from the public street right-of-way. When located on sidewalks, single lockers can be positioned either perpendicular or parallel to the road. When placed in other locations, lockers can be oriented in a number of ways but should be positioned to maximize ease of access to streets. Along residential or commercial streets with narrow sidewalks, lockers may also be placed in the curb lane.



Bike lockers (Dura Bike Lockers)

DESIGN GUIDANCE

- Single bike lockers should be placed in visible locations to maximize user security and minimize potential theft
- Sufficient lighting should be prioritized for nighttime use and clear signage provided to clearly mark lockers for users
- Placing bike lockers adjacent to active buildings and other areas increases their usefulness and security
- When located on sidewalks, lockers should have a minimum buffer of 24 inches to the curb and should avoid being placed directly adjacent to on-street parking stalls to avoid conflict with car doors
- If oriented horizontally, locker structures should be a minimum of 24 inches wide and 6 feet in length
- Vertically oriented lockers may be appropriate where horizontal space is limited
- In both cases, a minimum of 5 feet clearance at the access point of lockers should be provided for easy maneuvering

2b. Bike Hubs

Shared lockers or “bike hubs” provide a group of users secure storage for extended periods of time. Outdoor bike lockers offer long-term bike parking and may be either surface-mounted, embedded, or weighted in the ‘furniture’ zone of sidewalks or, more often, in other locations like plazas, parks, and or other public spaces. Bike hubs provide more weather protection and amenity than shelter or lockers and are accessed through a shared key or digital keycode. Spaces are available through a rental or permit system and usually accommodate anywhere from 2-50 (or more!) bicycles.

APPLICATIONS:

Shared bike lockers are typically installed at transit stations, large institutions or employment centers, and within public spaces adjacent to other types of high-demand destinations. They are also frequently installed along residential streets where groups of neighbors can have access. Shared lockers may be configured in a number of ways and installed in ‘in public spaces, at parking garages, in the parking lane, or located in publicly accessible private/ public land removed from the public street right-of-way. When located on sidewalks, shared lockers can be positioned either perpendicular or parallel to the road. If placed in the parking zone of the street, lockers can be oriented similarly to a bike corral. When placed in offset locations, lockers can be oriented in a number of ways but should be positioned to maximize ease of access to streets.



Oonee Pod Bike Hub,
Brooklyn, NY (Brooklyn Paper)

DESIGN GUIDANCE

- Shared bike lockers should be placed in highly-visible locations to maximize user security and minimize potential theft
- Sufficient lighting should be prioritized for nighttime use and clear signage provided to clearly mark lockers for users
- Placing bike lockers adjacent to active building frontages and other areas increases their usefulness and security
- When located on sidewalks, shared lockers should not be placed directly adjacent to on-street parking stalls to avoid conflict with car doors and exiting passengers
- In both cases, a minimum of 5 feet clearance at the access point of lockers should be provided for easy maneuvering

2c. Bike Parking Lots

Bike parking lots are large-scale short- to medium-term bike parking fields, usually featuring rows of surface-mounted racks in a standalone location. Bike parking lots can sometimes provide weather protection and may have security features such as cameras or nearby guard booths, and may be gated with an access code system or other membership control. Users secure bikes with personal locks. Can accommodate 20-10,000 bicycles.

APPLICATIONS:

Bike parking lots provide short-term outdoor storage for areas with extremely high demand, such as university campuses, employment hubs, shopping centers, and transit stations. They are appropriate for locations that are unable to manage demand along sidewalks or in bike corrals/shelters/lockers. Specific location criteria vary, but locating adjacent to multiple centers of activity or destinations such as transit hubs and shopping centers helps ensure maximum use of bike parking lots at all hours of the day and night.



Bike Station at Union Station
Washington D.C. (Ian Everhart)

DESIGN GUIDANCE

- Bike parking lots should be placed in centralized, visible locations to maximize user security and minimize potential theft
- Sufficient lighting should also be prioritized for nighttime use
- Adequate signage should be installed surrounding the parking lot to increase its visibility
- Placing bike parking lots adjacent to active buildings and other areas increases their usefulness and security
- Bike parking lots may include security cameras, guards, valets, and fenced-locking systems to increase security
- A minimum of 36 inches buffer should be kept between each individual bike rack to allow efficient access
- Additionally, an aisle with a minimum width of 48 inches should be provided to allow easy maneuvering

2d. Indoor Bike Parking

To complement a variety of outdoor bike parking options, indoor bike parking is a critical part of a citywide bike parking plan to increase cycling. Indoor bike parking is by far the safest way to park a bicycle and is thus extremely valuable to those riding expensive bicycles or anyone who can't afford to have a bike stolen. Indoors, cyclists can also feel much safer and more comfortable changing clothes or rummaging through their belongings. Indoor, long-term bike parking is usually located within car parking garages, commercial, office, or residential apartment buildings. Indoor bike parking provides weather protection and maybe be a freely accessible space or else accessed through an individualized key or digital keycode. Can accommodate 20-5,000 bicycles.

APPLICATIONS:

Indoor bike parking provides users secure and weather-protected storage. Often located in offices, transit stations, or other large commercial / employment centers, indoor parking facilities greatly increase access for bikers, especially in relation to routine activities and commutes. Access is usually shared among users of whichever building houses the parking facility, allowing shared but secure access among that group.



DESIGN GUIDANCE

- Indoor bike parking can take a variety of forms including simple wall-mounted bike racks, bike 'cages,' and fully equipped bike 'rooms,' housing not only secure storage but maintenance tools and often changing/shower facilities as well
- Dimensions for indoor bike facilities match those of outdoor fixtures; however, special consideration should be given to access points of indoor bike parking such as doorways, stairs, and elevators
- Because indoor bike parking is enclosed, these facilities are able to make use of wall-mounted and multi-tiered rack systems to maximize storage capacity

3. TEMPORARY BIKE PARKING

Outdoor, short-term bike parking often used in coordination with specific events to provide bike parking when demand exceeds the existing, permanent supply. Temporary bike parking often entails corrals or other weighted structures that can be moved after events conclude.

APPLICATIONS:

Temporary bike parking facilities can be set up on a one-time or recurring basis whenever there is large, fluctuating demand for bike parking such as at special events or seasonal destinations. Temporary bike parking is generally intended for short-term use and can be located outdoors or indoors depending on space availability. Temporary bike racks may be movable or collapsible and therefore necessitate some level of surveillance or on-site administration to deter theft.



DESIGN GUIDANCE

- Use 8' collapsible event racks instead of barricades, allowing 6 bikes per rack.
- An aisle with a minimum width of 48 inches should be provided to allow easy maneuvering.
- Use identification flags or other forms of temporary signage to assist with the finding and recovery within a large field of racks.
- Additionally, an aisle with a minimum width of 48 inches should be provided to allow easy maneuvering.

4. BIKE PARKING SIGNAGE

Bike parking signage directs cyclists to large bicycle parking areas such as corrals, shelters, lockers, and bike parking lots. It also designates such spaces specifically for bicycle parking separate from parking for vehicles, motorcycles, and scooters (if desired). Bike parking signage can be used with movable bases for temporary bike parking installations.

APPLICATIONS:

Bike parking directional signage should be used at high-demand locations, especially where large bike parking facilities may be located just off major bikeways and are not immediately visible. Directional signage can also be used where frequently improvised bike locking is observed as a way to direct cyclists to nearby facilities. Bike parking designation signage should be used at all bike parking facilities with five or more racks.



DESIGN GUIDANCE

- Bike parking signage uses the familiar MUTCD white background and colored border motif.
- These signs are generally smaller in size than traffic control signs and should be placed closer to eye-level alongside or very near to bicycle facilities.

GREEN INFRASTRUCTURE

This chapter of the design manual covers landscaping and greenery to be integrated into the design of bikeways in Jersey City, generally referred to as “green infrastructure” (or “GI” for short). The chapter’s entries highlight bicycle facility features and traffic calming elements from previous chapters where plantings and green infrastructure can be incorporated.

We note key benefits of trees and landscape as well as important maintenance considerations. This does not include detailed scientific information related to horticulture, arboriculture, ecology, or hydrology, but will provide some examples and references where such information might be obtained.

The rollout of the bicycle facilities recommended in the master plan is a remarkable opportunity to confer the many benefits of green infrastructure to communities across Jersey City, giving bikeways three-dimensional appeal and environmental performance which extends well beyond simple lane striping. In particular, the GI elements of Neighborhood Greenways are crucial for creating the intended kind of street that is safer, quieter, more attractive, and more livable.

Trees and plant material should not be considered optional decorations, incorporated only when funding is ample. Today, greening is recognized as a critical feature of urban street infrastructure, delivering a multitude of notable benefits which include beautification, traffic calming, cleaner air, cooling, shade, wildlife habitat, improved mental health, and, increasingly, stormwater treatment and flood mitigation. Maintenance should always be a consideration when installing GI solutions on the streets, but it should not preclude the city from installing them. The costs of a simple maintenance program are often times offset by the benefits generated. The numerous benefits are well-documented to generate substantial net property value increases relative to the cost of maintenance. If plantings are absent on streets, a neighborhood risks spiraling decreases in value which can exacerbate concerns about available maintenance capacity.



Furthermore, it is predicted that climate change will accelerate dramatically in the decades ahead. This means that Jersey City is likely to see more extreme weather events such as stronger and more frequent storms, flooding, and heat waves. Streetscape plantings in bikeway projects represent an important opportunity to mitigate some of the impacts of these events, as such plantings are significant components of the Jersey City Resilience Master Plan (2017). Greening streets is also a meaningful step for Jersey City to minimize its own contributions to the air and water pollution which causes global climate change in the first place.

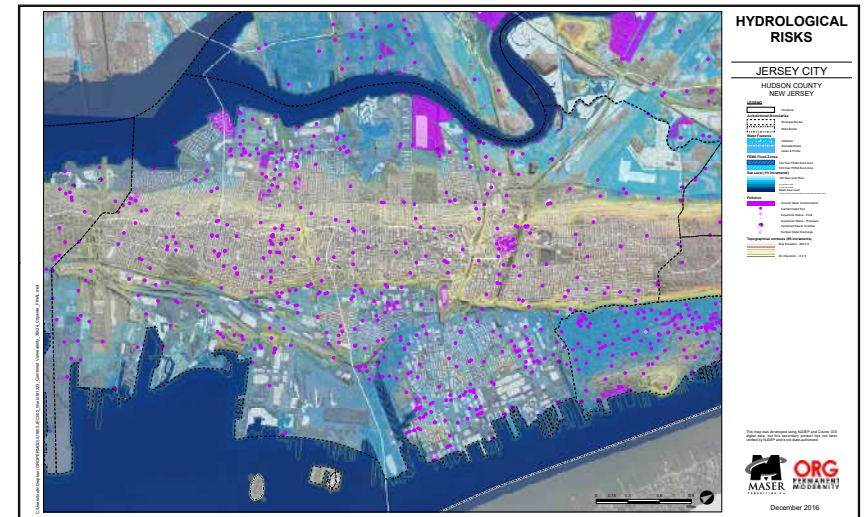


Indianapolis Cultural Trail,
Indianapolis, IN (Curbed)

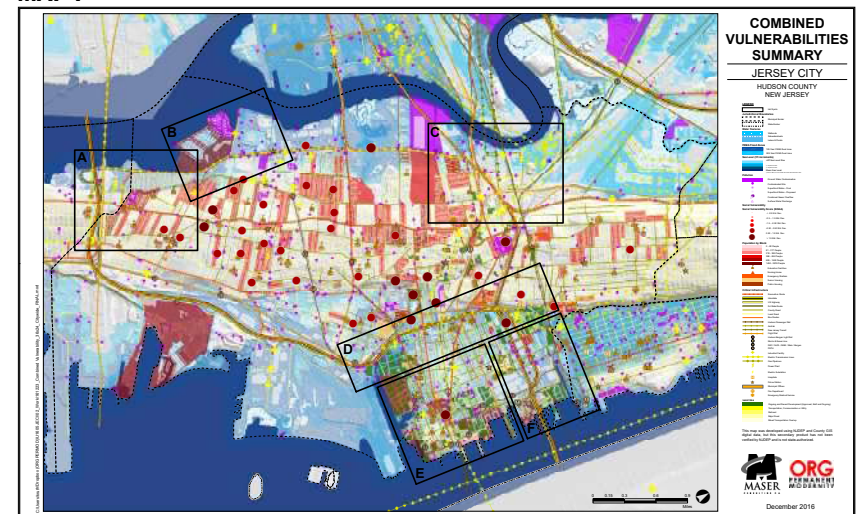
The maps to the right show areas of Jersey City which are at the greatest risk of flooding from torrential rains, severe coastal storms, and sea level rise. One map shows the purely hydrological concerns, while the other overlays social and economic vulnerabilities, as well as critical municipal infrastructure, in order to identify priority areas in which to focus mitigation efforts. Low lying waterfront sections of every ward except Ward C are extremely vulnerable to flood events, including nearly all of Ward E. As described in the Resilience Master Plan, source controls such as stormwater-capturing tree beds and planted areas in elevated neighborhoods can help address the rain flooding and combined sewer overflows downstream, while waterfront greenways, elevated planted berms, and wetland restoration projects could be designed to mitigate coastal impacts.

It is recommended that all street projects include Green Infrastructure interventions wherever possible, and always involve consultation with a certified arborist, horticulturist, hydrologist, soil scientist, and/or landscape architect. Plant and tree selection should follow applicable standards and guidelines, with a preference for native species and local sourcing. Species selection should be informed by a thorough analysis of the site features and consideration of the maintenance needs relative to available maintenance capacity, which should include opportunities for public-private partnerships and citizen-based stewardship as appropriate. Rather than addressing GI maintenance piecemeal, it is recommended that the City develop a citywide stewardship plan for these elements.

MAP 3



MAP 7



Hydrological risk and vulnerabilities maps, Jersey City
Resiliency Master Plan (City of Jersey City)Plans

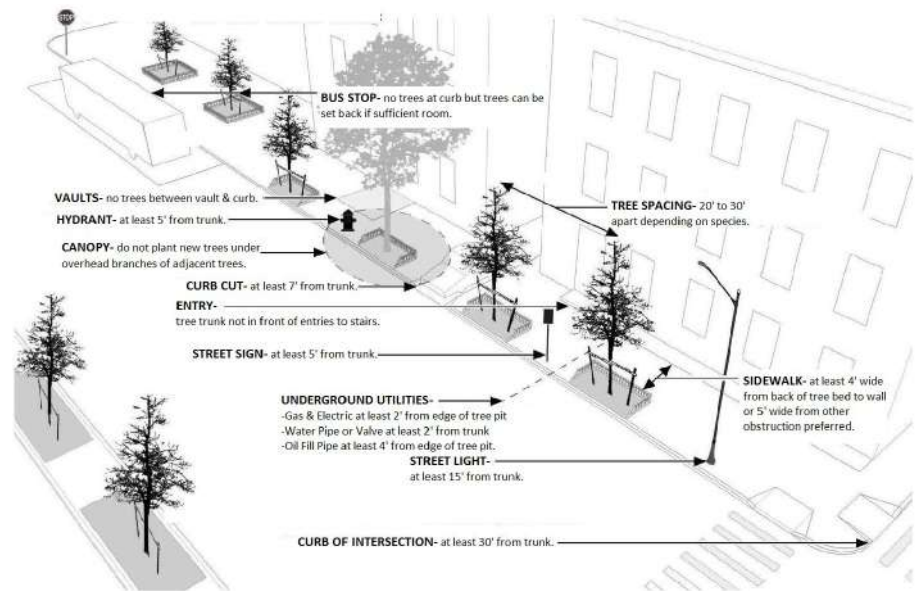
Street Trees

Street trees create especially pleasant conditions for cycling. Their leaves shade and dapple sunlight onto bikeways and offer beautification and visual interest. Long stretches of evenly-spaced street trees convey a rewarding sense of motion and progress along a route, as can be observed on the long-distance bicycle highways traversing Northern Europe.

Trees deliver a variety of important environmental benefits to cities. The shade they provide cools streets, buildings, and people on hot summer days, and reduces the need for air conditioning. Tree beds collect rain runoff from adjacent pervious surfaces which they can absorb through their roots. This process enhances the cooling impact and, where combined sewer systems are present, also reduces the amount of stormwater runoff which enters the municipal sewer system and contributes to polluted water entering waterways. Ecologically, trees also provide food and habitat for urban wildlife such as insects, birds, and squirrels, among others.

Street trees are planted in the ground of the public right-of-way to provide shade and greenery over the sidewalk and roadway. Street trees are typically planted along the curb of the sidewalk, in medians and refuge islands, or in open landscape areas. Where wider sidewalks are present, street trees are sometimes located within the walkways or along the building edge. Trees should never be planted in the direct path of pedestrians, vehicles, or bicycle traffic. Refer to the Jersey City Forestry Standards for guidance on tree planting.

Trees and their beds should not obstruct pedestrian crossing areas and should comply with clear path requirements to allow sufficient space for pedestrian traffic flow and circulation. Trees should be planted at least two feet from bikeways (more if space allows) and eight feet from intersections. For protected bikeways, especially elevated bikeways, the preferred placement for trees is between the bikeway and vehicle traffic.

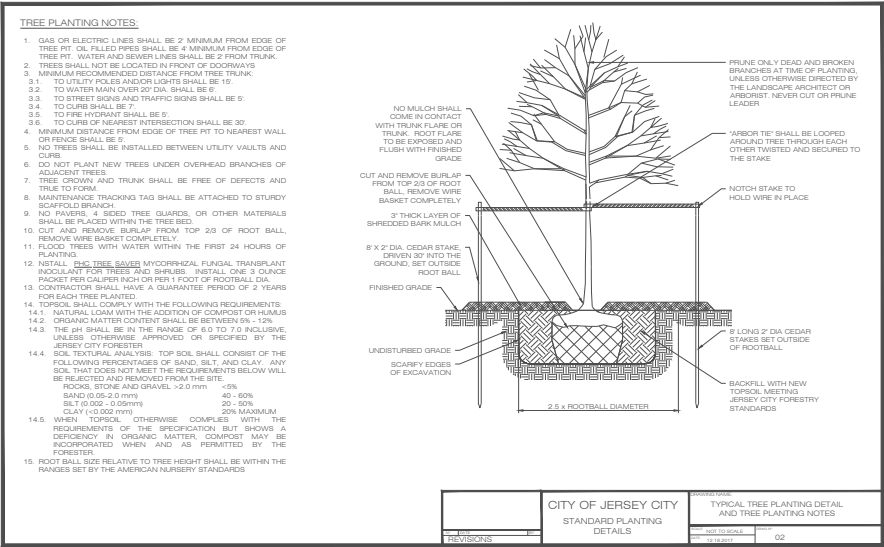


Street forestry standards
(Jersey City Forestry Standards)

Stormwater-capturing tree beds can be designed as walled boxes or continuous, connected trenches in response to surface and subsurface conditions. Keep in mind that larger trees will require greater soil volumes for roots to grow, so walled boxes, in particular, must be adequately spacious. Trees planted in the sidewalk should have an inlet to direct runoff to tree beds and may feature an outlet for overflow to drain to catch basin. These inlets may be a curb cut or grade depression, or a catch basin that circulates water among tree beds using a system of pipes or tubes.



Let's Ride JC Bike Master Plan



Tree Planting Detail Diagram (Jersey City Forestry Standards)

Planted Areas

Just like street trees, plantings have significant beautification, traffic-calming, and ecological benefits, as well as potential to capture stormwater as in the case of rain gardens and bioswales.

Planted areas of the sidewalk or roadway feature bushes, shrubs, grasses, perennials, and other vegetation which may or may not include trees. Planted areas are typically located adjacent to traffic such as along the curb of the sidewalk or in medians and sidewalk extensions.

Planted areas require appropriate species selection, soil mix, and structure for the site conditions, which should be determined by a certified professional. Planted areas should be composed of diverse, native vegetation, which considers species compatibility, watering requirements, and potential for wildlife habitat. Plantings should be scaled to the size of the bed and the required sightlines for drivers, cyclists, and pedestrians. For stormwater-capturing, the design must consider groundwater properties, grading, infiltration rate(s), and contamination. Planted areas should not obstruct pedestrian crossings and should comply with clear path requirements to allow sufficient space for pedestrian traffic flow and circulation. Just like with tree beds, dog urine, litter, vandalism, and trampling can be minimized by including low fencing, curbs, or barriers, or sturdy/hardy vegetation.

Bioswales are planted areas which are graded slightly lower than the sidewalk or roadway in order to capture and convey, stormwater. Unlike traditional curb gutters, bioswales are designed to capture and slow down the initial runoff at the beginning of a storm which is associated with the most contaminants. By slowing the water, the contaminants are allowed to settle and be filtered out of the stormwater before it reaches the catch basin. Bioswales are considered one of the most effective green infrastructure streetscape elements in terms of their ability to slow and filter stormwater and/or direct it into the groundwater table.



Let's Ride JC Bike Master Plan



Pike Street Mall
New York, NY (ASLA)

Curb Extensions

The term curb extension broadly applies to any part of the street where the sidewalk is made wider than in other parts and reducing the width of the roadway. This includes a variety of traffic-calming and pedestrian safety measures known as bulb-outs, neckdowns, chicanes, pinch points, diverters, and more.

Since curb extensions increase the sidewalk width, there are often substantial opportunities to fill them with plantings. In fact, any part of a curb extension that is not needed for pedestrian circulation or curb access should be considered for plantings which could capture stormwater.

When curb extensions are located at an intersection, it is critical to maintain access to the crossing and pedestrian ramp with a minimum 8' clear path. Where feasible, sidewalks and/or roadways should be pitched to direct stormwater into the planting beds. Plantings should be relatively low growing such as grasses and groundcovers which do not obstruct sightlines. Guards and fences should be considered to prevent trampling. Planted areas in curb extensions may be maintained by local organizations or citizen stewards.



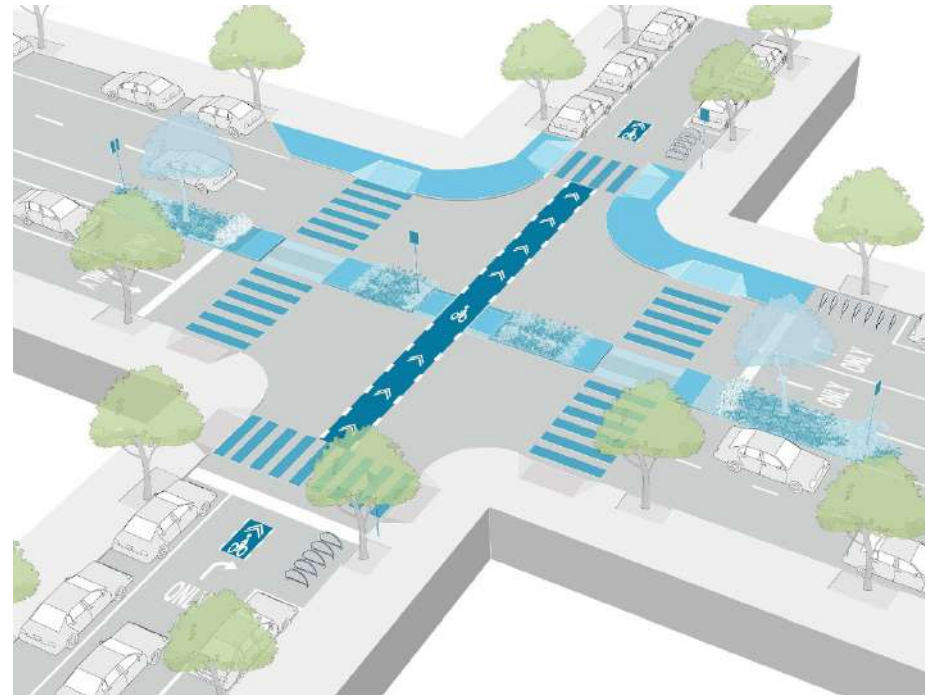
Medians + Safety Islands

Medians and safety islands are located between the curbs of the roadway, most often in the center. They can be 5 to 8-foot-wide strips separating street users or dividing opposing directions of traffic, or large triangles where roadways intersect.

Medians can be designed to be flush with the roadway, elevated to sidewalk level, or raised with barrier walls. Medians can feature a variety of different types of plantings from shrubs to grasses to flowers to trees.

Medians must be designed to allow space for vehicle travel and turning movements without damaging the plantings, and 5-8' of clear space for pedestrians and bicycles to wait or cross at intersections. Based on the constraints of the growing area and the exposed environment, plant selection should consider numerous stress factors that include the sun, drought, inundation, wind, litter, salt, and trampling/compaction. Maintenance of median plantings can be particularly tricky when there are moving lanes of vehicle traffic on either side. For medians which are inaccessible from a pedestrian refuge area, watering is often done via watering truck and planting/pruning by a professional crew experienced in street work.

Because center medians are typically located at the top of the crown of the roadway, they are often less effective at stormwater capture than sidewalk planted area. However, based on the grading of the street, they can be impactful, and as streets are reconstructed, roadways can be pitched into the center to form a planted ditch with substantial stormwater capturing capacity. Wide, triangular medians can feature full-scale gardens. Planted areas in medians may be maintained by local organizations or citizen stewards.



Planted median, location unknown,
(Dan Burden /pedbikeimages.org)

Mini-Roundabouts

Mini-roundabouts present a unique opportunity to showcase highly-visible plantings which punctuate the streetscape at intersections for the purpose of traffic calming and placemaking, similar to a gateway treatment.

In a number of northwestern cities such as Portland, Seattle, and Vancouver, there are citywide programs to install mini roundabouts (also called neighborhood traffic circles) whereby local residents can apply to have one installed and volunteer to plant and maintain it. Much like a community garden plot in an area of heavy demand, this privilege can be so competitive that cities have to develop a prioritization system to determine who will be granted permission to manage and maintain the plantings (for example, residents at the immediately-adjacent four corners may get the right of first refusal).

Mini-roundabouts have planting requirements similar to medians, although there is a preference for colorful and varied seasonal flowers. This requires more intensive maintenance, so citizen stewardship is highly recommended. Plantings may include trees and taller vegetation but must be clear of required sightlines for drivers, cyclists, and pedestrians, as well as traffic signage - having plant mass below the 30" plane and tree canopies above 60" is one suggestion. The stormwater capturing potential of mini roundabouts is not significant based on their central location within the crown of the roadway, but on sloping streets, the plantings may benefit from an opportunity to receive some street runoff.



Landscaped mini-roundabout,
location unknown (NACTO)

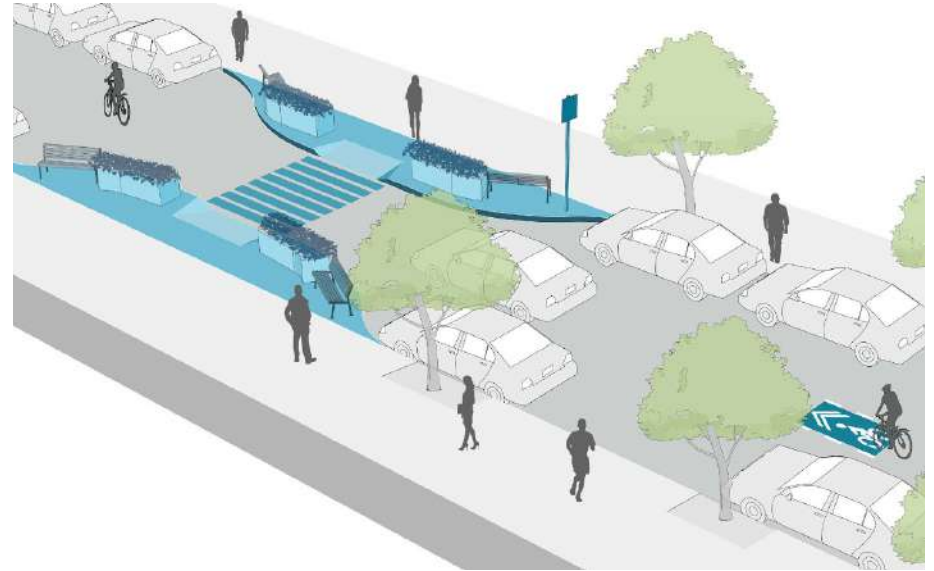
Movable Barrier Elements

Barrier elements on the street provide enhanced protection for pedestrians and cyclists from vehicles. They are commonly found at the edges of pedestrian areas and public spaces and occupying the buffer of a protected bike lane.

When pedestrian and bicycle facilities are built with temporary surface treatments, or when flexibility is desired, moveable planters may be used as a barrier element. Moveable planters come in a variety of shapes and sizes that can accommodate all manner of different plantings. Round planters are strongly advised if not fixed in place because rectilinear ones can look disorderly when not perfectly aligned which can make the task of straightening them highly tedious.

There are many important factors to consider when selecting barrier elements for a protected bicycle facility. They must be a slim enough dimension to fit within the buffer area without encroaching on the bike lane. They should also be tall enough to provide adequate visual distinction but not so tall as to obstruct sightlines (30"-42" is a good height range). Barrier elements may also need to have a crash rating based on their placement relative to the chance of a vehicle colliding into them. Higher crash ratings may require larger, heavier planters with flexible materials that won't splinter or shatter on impact. The total height of planters and plantings should not exceed 36" when placed near intersections and driveways where clear sightlines are paramount. At intersections, planters may feature footrests for cyclists.

Moveable planters must have drainage holes in the bottom so they don't fill up with water which would drown and rot plants. Unfortunately, this means that, especially in sunny locations, the soil may be prone to drying out quickly. In peak times of dry summer heat, watering must sometimes be as frequent as every other day, thus selecting plantings which are drought tolerant is strongly advised. Otherwise, plantings can be almost any kind that provides beautification and visual interest. Maintenance by local organizations or citizen stewards should be considered where feasible.



Planter-protected bike lane,
Vancouver, BC (Street Plans)

Fixed Barrier Elements

Fixed barrier elements perform the same basic function as moveable ones, but with a permanent attachment to or integral construction with the streetscape surface.

What makes a fixed barrier element within the roadway different from a median is that they are narrower— only as wide as a buffer, which does not provide refuge at crossings— and that they are typically at least 12” tall to cause deflection when crashed into by vehicles. As with moveable planters, the total height of planters and plantings should not exceed 36” when placed near intersections and driveways where clear sightlines are paramount. Fixed barrier elements should have breaks every 25-50 feet and at all crossings for pedestrian access. As with other vertical elements, careful consideration must be paid to keeping sightlines clear, especially at intersections.

Fixed barriers can be constructed as continuously connected such that there is greater overall soil volume to retain moisture, lessening the required frequency of watering. They can also be designed with breaks in the edge to capture stormwater just like planted areas and medians. Plantings should not grow outside of the barrier so they should be chosen for vertical growth or else carefully maintained. Maintenance by local organizations or citizen stewards is recommended.



Off-Street Paths

Off-street paths including sidepaths, greenways, and trails have the greatest capacity for planting. Often located in parks and natural areas, off-street paths should maximize vegetation for shade and beautification.

Although off-street paths are safer and generally more pleasant to ride than on-street lanes, they can be monotonous when traversing long stretches of exposed, undeveloped lands. Plantings should be dense and varied with a substantial tree canopy, understory, and ground cover, while allowing for view corridors where there may be intersections, decision points, vistas, and points of interest.

Plantings on off-street paths should be selected, planted, and maintained to avoid overgrowth encroaching in the path. Off-street bikeways may run alongside areas that manage stormwater with natural formations such as wetlands or constructed bioswales. At the least, the off-street path should shed all rainwater off the paved surface into gardens and beds along the side(s). In developed areas, off-street paths should feature robust stormwater capturing capacity to absorb runoff from adjacent roadways and structures.



MICOMOBILITY SHARING

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The Let's Ride JC Bicycle Master plan was created in the midst of a transformational period for the field of urban transportation, particularly concerning how individuals move around cities day-to-day. The future of mobility options is still uncertain, but we have seen major changes in the past decade that have had profound impacts on how city streets are used, and to a lesser extent, designed and managed.

Widespread dissemination of GPS and smartphone devices has given rise to a variety of often disruptive tech-related transportation products and services from ride hailing to transit, to navigation, to shared micro-mobility options that include bike and scooter share systems.

The term “micro-mobility” and “shared active mobility” have been used to refer to private, street-based systems comprised of small vehicles like bikes and scooter that are rented to the public at multiple, dispersed locations. The vehicles may be human-powered, motorized/battery-powered, or a combination of the two. The first generations of these systems involved customers picking up and returning bikes at stations with multiple “docks” located within a defined geographic service area. Some newer systems no longer use stations but instead allow small, GPS- enabled vehicles to be picked up or left anywhere in the service area using a smartphone app to execute the rental/return. Many companies are now using a hybrid approach that combines the flexibility of dockless technology with the visibility and predictability of docks.

Across the country, bicycle and scooter share systems have, for many users, delivered an entirely new transportation option. Without worrying about ownership, maintenance, residents, and visitors can have ready-access to bikes and scooters at origin and destination points across any given neighborhood, city, or region. In places like New York City and Jersey City, bike sharing has emerged hand-in-hand with soaring bicycle use, influenced by strong population growth and declining service quality (e.g. frequency, reliability) in traditional transportation options. Furthermore, ride hailing



services appear to be siphoning off transit ridership and increasing vehicle trips, exacerbating transit funding issues and adding motor vehicle traffic that slows bus travel times. As further growth and development are on the horizon for Jersey City, it is a crucial time to make a forward-thinking examination into how shared mobility services can be safely and efficiently integrated into the transportation network so that benefits are maximized and costs or negative consequences are minimized.

The various characteristics of shared micro-mobility systems along with their advantages and disadvantages are described herein. This includes an exploration of street design implications related to these systems, with a specific focus on Jersey City and its pertinent policy and regulatory framework, and an examination of the existing CitiBike system. Finally, we will review some relevant emerging best practices and offer some guidance about further developments that may be coming down the pipeline.

1. Bike Sharing

1a. Docked Systems

Bicycle-sharing systems of some form or another have been around since at least the late 20th-century, but the more modern urban systems in the United States were largely inspired and informed by the large-scale rollout of Velib in Paris and Bicing in Barcelona in 2007.

European systems were the precursors to the CitiBike system that operates in New York (since 2013) and Jersey City (since 2015). They feature annual subscription-based memberships coupled with the single ride and day-pass options allowing customers to borrow and return bikes from on-street stations.

Bikes can be rented and ridden for a limited period of time (e.g. 30-45 minutes) as many times as one wants at no additional cost beyond the base membership or pass fee. For longer trips, graduating fees are assigned. These additional fees are intended to encourage short, local trips while discouraging long rides - this keeps more bikes readily available in the system for more users to make quick, convenient trips analogous to an urban transit system.

In concept, this means that subscribers who live and/or work within the service area can have access to a bike 24/7/365 without having to own, store, or maintain one themselves, at an annual cost that is a fraction of the price of a new bike. For many would-be urban cyclists, owning, storing, and maintaining a bike in a small apartment or an area where theft is common is a primary “barrier to entry” that discourages them from riding. Bike share service eliminates that hurdle and, as a result, generally causes a large uptick in citywide cycling volumes. Recently, bike share systems have added battery-powered electric-assist bikes that require less physical strength to ride at a faster speed - an attractive option for older riders, or those making trips which cover longer distances or hilly areas.

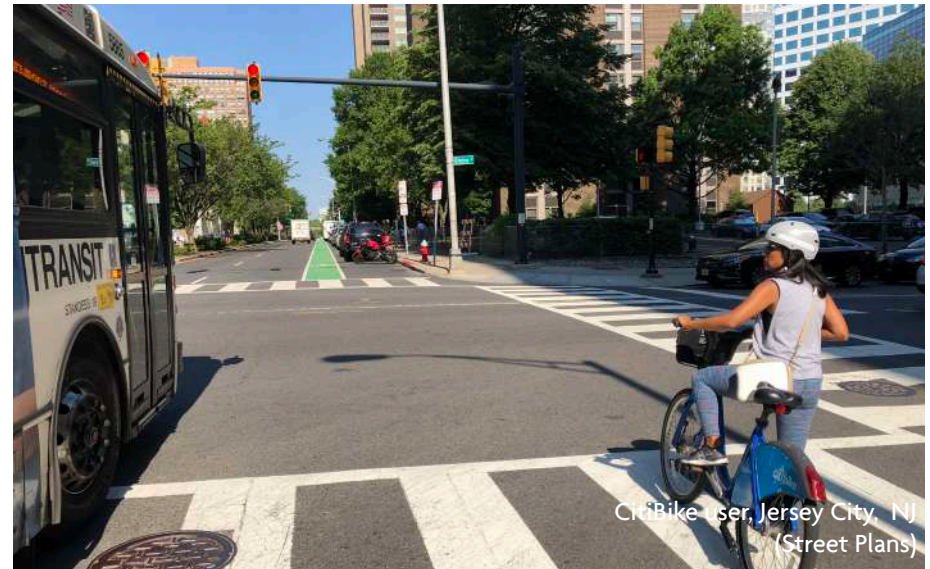


CitiBike station, Jersey City, NJ
(Street Plans)

Bike sharing systems are beneficial for compact cities because they greatly increase the number of trips made by bicycle. Cycling is one of the most efficient uses of street space for transportation, along with walking and bus riding. Cycling is often the fastest way to make short trips (e.g. less than 2 miles), is cheaper than driving or transit, and involves healthy physical exercise. More cyclists on the road also induce a “strength in numbers” effect where the relative number of crashes per cyclist goes down as the overall volume of cyclist traffic goes up. Any major city that is serious about having a safe cycling network and a meaningful cycling mode share should have some kind of bicycle sharing system available.

A critical focus in designing traditional bike share systems is station location and spacing (aka “density”). Stations need to be strategically located close to where users’ trips are likely to start and end (e.g. residential areas, transit stations, job centers, shopping areas, civic buildings, and points of interest). Users will not want to have to walk more than a few blocks to/from a bike station or else it will take too long to make the door-to-door trip compared to other options. Stations need to be located in visible, accessible places such as in the parking lane and along the curb or property line of well-traveled sidewalks. One of the key benefits of the docked systems is the highly-visible stations serve as a ubiquitous advertisement for the system within the service area and provide kiosks that can offer membership/pass purchase, information, and wayfinding. Branding and visibility are key success factors for bike share systems.

Another important consideration is availability. To be useful, customers need to be able to consistently access the bikes and return them to a dock upon arrival. When stations are depleted of available bikes, or when they are full such that there is no empty dock at which to return a bike, the system operator must “rebalance” the system by moving bikes from stations that are full to stations that are empty. This must happen routinely throughout the day to make sure that the system is responsive to user demand. A failure to adequately rebalance the system severely limits the usefulness and results in a lack of customers to make the service financially viable.



1b. Dockless Systems

With the advent of smartphones and GPS technology, entrepreneurs developed bike share locking mechanisms that obviate the need for stations. These bikes can be rented via a smartphone app that unlocks a bike wherever it is located.

Users can find nearby bikes using the app, as the bikes themselves are equipped with GPS tracking. Even if users don't have a smartphone, many systems allow for the bikes to be unlocked simply by entering a unique PIN on a keypad integrated into the bike's computerized locking mechanism.

A huge advantage of dockless systems is that, without stations, docks, kiosks, and related infrastructure, they cost considerably less to rollout. Dockless systems also allow riders to get off and lock up as close as possible to their destination without having to search for a nearby station with available docks. This gives the operator enormous flexibility to expand (or contract) the service area simply by adding/removing bikes and updating the program's maps and software - no station installations or removals are required.

There are some key disadvantages to dockless systems. For one, if you don't have stations, you lose the visibility and promotional effect that stations bring, as well as the features of the kiosks. The opportunity to re-purpose valuable curbside space into a more productive user (i.e. serving more people per available linear foot) is also diminished. In addition, not having stations means that the location of bikes can be harder to predict, and finding a bike could be difficult for anyone who doesn't have access to the smartphone app or website. And the more spread out location of the bikes means that the operating crews have a bigger task when it comes to rebalancing the system.

However, the drawbacks can be mitigated simply by integrating stations into the system. Most of the locking mechanisms for dockless bikes can easily be configured for station-based system designs. The design of the stations can



be quite flexible, using docks, racks, or simply a designated area to pick-up and return bikes (enforced by a GPS-enabled "geofence"). Kiosks can be added if desired, as well as the signage and wayfinding that comes with traditional stations. And if a city launches a fully dockless system or expansion area, it can always change to a station-based system later, only now armed with fine-grained data about exactly where users want to pick-up and drop-off bikes which come from operating the dockless system. A number of cities with bike sharing are now using a combination of both types of systems, or a hybrid of the two - in some cases it may be possible to combine both docked and dockless options in a unified program.



CitiBike recently added electric bikes to their system in New York City (CitiBike)

2. Scooter Sharing

Scooter sharing arrived in the US in a big way in 2018, mostly as dockless systems. Unfortunately, the rollout of a number of these programs happened overnight and in an unsanctioned manner that gave the concept a bad reputation among municipal departments and specific street users.

Cities were caught by surprise and did not have clear regulations regarding the use of these kinds of vehicles, with conflicts related to sidewalk riding and parking causing negative reactions from pedestrians. This was compounded by the fact that users were leaving the dockless electric scooters strewn around sidewalks and walkways in a disorderly fashion. However, as some of the initial controversies have subsided, many cities where scooter sharing operates have grown to see their distinct benefits.

For one thing, unlike bikes that require lessons to learn how to ride, scooters are much easier for novices to use - most adults are able to hop on, begin riding and get the hang of them within a ride or two. They are smaller, lighter weight, and more portable than bikes, making it easier for riders to stop and start, switch between walking and riding, and get on and off sidewalks. Standing upright, riders can easily and seamlessly transition from walking to riding in the same clothes - including dresses - without taking off bags and purses. The electric motors do most of the work, so there is not much physical exertion; your wardrobe is no longer a major factor.

Dockless scooters systems typically operate much the same way as dockless bikes - with app-based membership and activation - except that in most cases the membership is free or a nominal cost and users are charged graduated fees for every ride according to the trip duration. They take up less space than bikes and can have similarly painted corrals to organize pick-up and drop-off sites at designated areas.





People on scooters (and bikes) took to the protected Bergen Avenue demonstration lane before it was even completed. (Street Plans)

3. Design + Policy Considerations

LEGALITY

One of the first complicating factors for scooter systems and e-bike sharing for most cities is determining how they are classified and regulated, and where they should be ridden (on the street or the sidewalk). In March 2019, the State of New Jersey passed legislation authorizing the use of “pedal assist” electric bicycles limited to 750 watts and a maximum speed of 20 miles per hour as well as e-scooters with a maximum speed of no more than 19 miles per hour. According to the state law, e-scooter may be ridden on streets or sidewalks and parked on the sidewalk so long as they do not obstruct pedestrian traffic. This means that it will be up to individual municipalities to determine if they wish to restrict scooter riding on sidewalks to enact local legislation accordingly. At this point, throttle-controlled e-bikes are not included and remain in something of a gray area where they are likened to mopeds. However, this area deserves additional consideration as both electric and gas-powered moped sharing systems have been developed and could provide yet another evolution of the transportation category, along with electronic skateboards and other emerging technologies.

In February 2019, CitiBike began growing the number of available e-bikes in its New York City fleet. At the time of writing, this effort is on hold while they resolve an issue with the bicycle’s braking mechanism. In April 2019, the City of Hoboken announced they would begin a 6-month scooter sharing pilot program with two private operators. Hoboken’s program will require that e-scooter users ride on streets and within bike lanes, not on the sidewalk.

EQUITY

It is crucial that equity be a primary consideration when determining the boundaries of the system’s service area. Micro-mobility systems that operate on public streets represent a public service just like a mass transit system and cannot be oriented solely around where the most revenues are generated. In April 2018, Citibike announced the relocation of 8 stations in Jersey City - 15% of the total - that were deemed to be underperforming. This adjustment left some entire communities without access to the system, while station and bicycle density was increased in busy, affluent downtown areas. This has a profoundly negative impact of residents who lose access to the service and contributes to a sense of unfairness and exclusivity for the program.

Some of the strategies that have been employed in other cities to increase system equity include engagement, discounts, and direct subsidies. Engagement programs are designed to explain the system, its benefits, to generate more use in areas where ridership is not meeting expectations. Discounts for youth, students, seniors, and/or low-income customers (typically verified through participation in some other income-based benefit program) can also increase ridership and encourage participation by residents of greatest need. A subsidy strategy can also be developed such that high-performing stations (in terms of usage and revenue) offset operating losses for lower performing stations, and states or municipalities can also support the program with operating or capital funds to make sure that service is meeting equitable distribution goals, similar to transit systems.

Finally, communities that are underserved typically don’t have access to a strong bicycle network, making the provision of a bike share system less attractive for residents as riding on dangerous city streets suppresses use. Thus, investing in the bicycle network in these areas is another strategy that will support the use of bike share stations. Bottom line: people must feel safe while riding.

SERVICE AREA

Determining the appropriate service area size and station density for a micro-mobility sharing system is a complex and dynamic exercise. The city and the operator must strike a balance between broad enough coverage to appeal to a critical mass of customers, with an adequate station and bicycle density to meet customer origin and destination demands, but not overextending or over-saturating the system to the point that the financials don't pencil out. Cities, therefore, have to carefully consider what neighborhoods they want to serve, how many bikes or scooters are needed in order to offer a meaningful level of service of users, and the operating and administrative capacity of the operator and the city.

Micro-mobility systems must also consider the broader mobility needs of city residents, and calibrate policies and programs to ensure that these systems are accessible and comprehensible to all populations in an equitable manner. At a minimum, the rollout and ongoing administration of such programs should include a robust engagement effort that keeps all residents well-informed of the program and provides opportunities for meaningful feedback. Any significant changes to the program should include public hearings and outreach campaigns with materials available in multiple languages appropriate to the local neighborhoods.

SITING

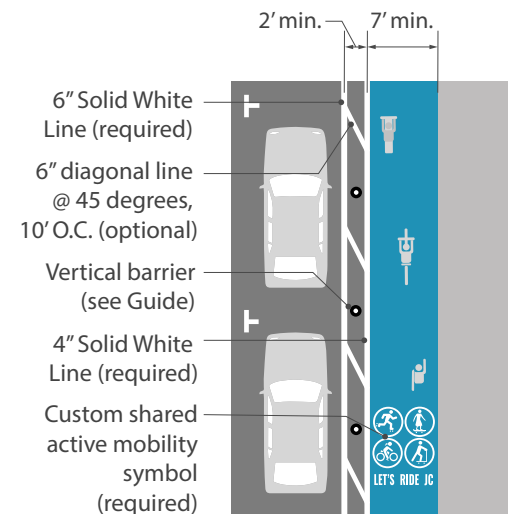
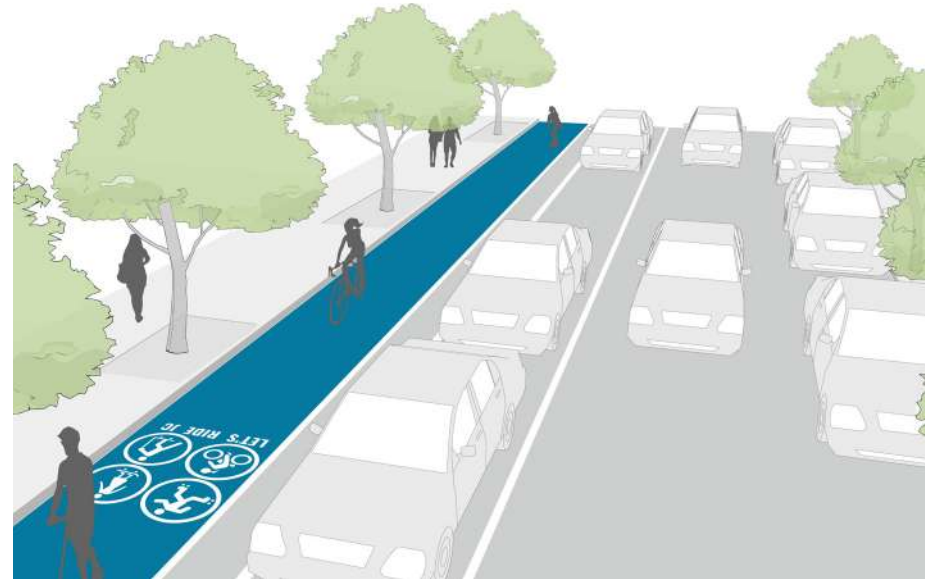
It is critically important not to compromise pedestrian access when locating bike and scooter share stations, corals, or designated parking areas. Existing vehicle parking lanes are usually the best places to locate bike share stations as these areas are already designated for vehicle storage but can be repurposed to host numerous bikes and scooters serving dozens or even hundreds of users each day. Daylighting zones close to intersections are especially well-suited for this use. Sidewalks, parks, and plazas can be used too as long as it does not impede pedestrian flow and is not inconvenient for users. Spacing and clear path requirements are comparable to bike racks as referenced in Chapter 6. When siting a bike station in the roadway where there is a curbside protected bike lane, the bike lane should continue straight between the station and the curb.

Bike share stations and bike network facilities benefit from being co-located. Certainly, any location in a bike share service area where two major bike network nodes intersect should include a large station. Ideally, these stations are located immediately alongside the bikeway facility. Because bike share is generally used by a larger pool of less experienced cyclists, areas of high station and bicycle network density should feature the most protected types of bike facilities as well as increased information and wayfinding signage.

BIKEWAY DESIGN CONSIDERATIONS

One issue that has emerged with the advent of e-bikes and e-scooters is an increased mixing of users traveling at a variety of different speeds. Even before electric motorization, novice cyclists might be riding at speeds at or below 10 miles per hour, while a few experienced cyclists can be riding at speeds greater than 20 miles per hour. Motorized bikes and scooters will generally be faster than the average cyclists and also accelerate at a much faster rate with the assistance of the electric motor. For this reason, it is recommended that riders moving at different speeds be accommodated by an increase in bike lane width wherever feasible. This should be a minimum of 6' of horizontal operating space for designated unprotected bikeways, or 7' for protected bikeways, as was showcased at the Bergen Avenue protected bikeway demonstration project that was part of the Let's Ride JC planning process in October 2018.

A final important consideration in micro-mobility service is safety. Bike share systems have a strong track record of being at least as safe as urban cycling and also contribute to the "strength in numbers" effect referenced above. However, there are some reports that use of e-scooters has correlated with an increase in injuries and hospitalizations in places where scooter share systems have been deployed and existing infrastructure/pavement conditions are of a low quality. Data regarding the relative safety or danger of scooters compared to other modes of travel is not conclusive to this point. This is an area that should be studied further and monitored closely as more micro-mobility options are established. However, given that scooters and skateboards have smaller wheels than bikes and cars, it is important that streets and bikeway facilities, or shared use paths in micro-mobility service areas, have even paving free of large cracks, bumps, potholes, grade changes, and debris. This warrants more intensive inspection of pavement conditions along these routes and paying more attention to street cleaning, snow clearance, and a pavement maintenance program. While this will incur a cost, the benefits will spread across all street users, no matter their mode or physical ability.





The Bergen Avenue demonstration lane tested new pavement markings that invited a broader group of users. (Street Plans)

LET'S RIDE IC

QUICK-BUILD: AN ITERATIVE APPROACH

TO PROJECT DEVELOPMENT + DELIVERY

We see it in small, mid-size, and large cities all over the world: the expedited delivery of public space and transportation projects. Based on the Tactical Urbanism approach developed by design firm Street Plans, the Quick-Build methodology is Tactical Urbanism 2.0.

Tactical Urbanism refers to a city, organizational, and/or citizen-led approach to neighborhood building using short-term, low-cost, and scalable interventions to catalyze long-term change. This movement has evolved within the last decade from a frustration with the lack of government response to citizen cries for safer streets and better public spaces to sanctioned programs and pilot projects embedded within the city and regional governmental bodies. Examples include highly-visible and formalized efforts, such as New York's Pavement to Plazas program, or San Francisco's parklet program, both of which have been replicated in dozens of cities across North America. More locally, the City of Burlington's Tactical Urbanism Policy and Quick Build Program, adopted in 2016, has already been used to build out interim elements of the city's North End Neighborhood Greenway (at right).

Cities and regions everywhere are not only recognizing the benefits of the iterative methodology, but they are also prioritizing it as a legitimate form of project delivery as line items in their budgets, teams comprised of internal leadership, and separate, streamlined permitting processes. More and more we observe the phasing out of the "pop-up", and the introduction of less stringent regulations that allow for flexibility in testing projects to arrive at more informed and cost-efficient, long-term projects.

One of the greatest benefits of the Quick-Build methodology is its multiple applications. A project can be a Quick-Build project if it:

- Is implemented on a much faster timeline than a capital project, within 1-2 years maximum;
- Uses impermanent and low-cost materials to test and iterate upon the design of infrastructure;
- Is short in duration, but meant to inform a permanent project;



- or, all of the above.

Projects that are temporary in nature are broken down into four durations (seen on the following page), informed by the durability of the materials used and the strategy for implementation.




Regardless of the time interval, however, this approach is all about **action**

Jersey City has already put paper to pavement, with a demonstration project on Bergen Avenue as a part of the Bike Master Plan public engagement. Using the Quick-Build methodology, the city is poised to start implementing the Bike Master Plan, including the interventions detailed in the Bikeway Design Guide, almost immediately. By doing so, the city can avoid a lag between the adoption of the Bike Master Plan and getting infrastructure on the ground to solicit public feedback and conduct evaluation.

Quick-Build projects may be implemented citywide, but are most appropriate for streets designated by the Bike Master Plan as a slow-zone, Neighborhood Greenway, or bike priority corridor. If a Quick-Build project is successful, then it will have the opportunity to be refined and maintained until made more permanent with long-lasting materials. If a project is not well-received or does not achieve its intended safety and accessibility outcomes, it may be removed or altered.

In the pages that follow, Quick-Build examples of some of the interventions from the Design Guide's chapters (Bikeways, Neighborhood Greenways, and Intersection Treatments) are detailed to give the city a jumpstart on the application of the methodology.

This chart illustrates the progression of an iterative approach to project delivery. Though not all projects need to follow this exact model, it can be helpful to see how each project phase may inform the next, and how elements like materials and the project delivery mechanism differ as projects achieve various levels of permanence.

				
	DEMONSTRATION (1 day - 1 month \$)	PILOT (1 month - 1 year \$\$)	INTERIM DESIGN (1 year - 5 years \$\$\$)	LONG-TERM/CAPITAL (5 years - 50 years \$\$\$\$)
Project Leaders	Can be led by anyone (city, citizen group, or both!)	Government / organizational leadership + involvement required	Government / organizational leadership + involvement required	Government / organizational leadership + involvement required
Permission Status	Sanctioned or unsanctioned	Always sanctioned	Always sanctioned	Always sanctioned
Materials	Low-cost, typically low-durability. Can be borrowed or easily made	Relatively low-cost, but semi-durable materials	Low-moderate cost materials, designed to balance flexibility with maintenance needs	High-cost permanent materials that cannot easily be adjusted
Public Involvement	Public input + public action	Public input, champion engagment, government / organizational stewardship	Public input, government / organizational stewardship	Public input, government / organizational stewardship
Flexibility of Design	High: organizers expect project to be adjusted and removed.	High: organizers expect project to be adjusted; it may be removed if it does not meet goals	Moderate: organizers expect project to be adjusted, but it is intended to remain in place until capital upgrades are possible	Low: project is considered a permanent capital upgrade that is unlikely to be adjusted significantly once installed
Collect data to refine approach for current or future projects?	Recommended	Always	Always	Always - project performance can inform future investments

Terms and diagram format based on PeopleForBike's "Quick Builds for Better Streets," which defines the pilot / interim time intervals above as "Quick Build" projects. To access Quick Builds for Better Streets, visit: bit.ly/QuickBuildsReport (Images: Street Plans).

Protected Bike Lanes

DEMONSTRATION



Protected Bikeway Providence, RI

This demonstration project, a part of the City of Providence's CityWalk Initiative, was installed in a day and a half and lasted for a weekend. For the protected bikeway striping, **foil-backed traffic tape** was used. Conflict zone and bike lane markings were painted on **tar roofing paper** with acrylic paint and spray chalk, and adhered to the asphalt with foil-backed and duct tape. **Movable "wave delineators"** provided by Bike Fixation created additional protection in the bike buffer zone.

It was one of the multiple interventions on Broad and Public Streets, which were programmed over the weekend to engage the community and solicit feedback about how Broad Street could be made safer for both pedestrians and bicyclists.

PILOT



Protected Bikeway Akron, OH

This pilot project, on Exchange Street in Akron, OH, remained for one month for the city to evaluate the infrastructure in the context of its future Complete Streets capital program. A combination of **contractor-grade traffic tape**, white **Rustoleum traffic paint**, and **AquaStripe field marking paint** from US Specialty Coatings comprised the striping and pavement markings. **FlexStake delineator posts**, adhered to the asphalt with epoxy, were used as protective barriers.

The city evaluated the bikeway's impact on motor vehicle speeds and flow, and conducted pedestrian and bicyclist counts. Public feedback was also solicited through online surveys posted on temporary project signage.

INTERIM DESIGN



Protected Bikeway Burlington, VT

The City of Burlington's Quick Build Program has implemented 6 projects identified in the PlanBTV Walk/Bike Master Plan. This includes the 1.25-mile Old North End Neighborhood Greenway (pictured above), which various protected bike lane configurations, green-backed super sharrows, and a series of painted curb extensions. Materials include **traffic paint**, **metal wayfinding signs**, **vertical delineator posts**, and **Sybertech self-watering planters**.

The city is evaluating facility as well as material performance so it may tweak its approach to implementation and maintenance as more links in the bikeway network are rolled out.

Neighborhood Greenways

DEMONSTRATION



Roundabout Cudahy, CA

This demonstration project, a part of the Southern California Association of Governments' (SCAG) GoHuman campaign, was installed at a four-way stop using **straw wattle** (as "curbing"), **movable plastic stanchions**, and (donated) **potted plants**. All of these materials were removed after a single-day event.

These projects were heavy on programming, as they were a part of a larger initiative to promote safe walking and biking throughout the Southern California region. Demonstration days featured things like music, Zumba, food trucks, and street games.

PILOT



Traffic Diverter Bentonville, Ar

This diverter was implemented as a part of a Neighborhood Greenway pilot project, which included green-backed super sharrows and new crosswalks. To create the diverter, green and white **EcoStripe field marking spray paint** was used. **Galvanized metal planter boxes** from Pottery Barn, filled with donated soil and flowers chosen by a neighbor, created safe and inviting physical barriers.

For this project, the neighbor who chose the plants also volunteered to steward the diverter by watering the plants and keeping them looking fresh. It's a good idea to try to find local champions like this to help out with maintenance, and create a constituency of people passionate about seeing the intervention stick around.

INTERIM DESIGN



Pinch Point Burlington, VT

The City of Burlington's Quick Build Program has completed the interim implementation of its North End Neighborhood Greenway. Pictured above is a pinch point, created by a curb extension opposite on-street parking.

The materials used include white and tan **traffic paint** to delineate the curb extension/pinch point, **Sybertech self-watering planters** for beauty and enhanced protection, and **K-71 plastic bollards** for vertical barriers and reflectivity.

Intersection Treatments

DEMONSTRATION



Median Refuge Island Rancho Cucamonga, CA

This demonstration project, a part of the Southern California Association of Governments' (SCAG) GoHuman campaign, was installed on a five-lane arterial using **straw wattle** (as "curbing"), **stacked hay bales**, and (donated) **potted plants**. The art crosswalk was painted tar roofing paper taped to the asphalt with duct tape! All of these materials were removed after a single-day event.

These projects were heavy on programming, as they were a part of a larger initiative to promote safe walking and biking throughout the Southern California region. Demonstration days featured things like music, zumba, food trucks, and street games.

PILOT



Crossbike Markings Bella Vista, AR

This crossbike was the first of its kind in Bella Vista, and was installed to provide a more visible and safe crossing for bicyclists accessing two sets of trails. **Contractor-grade traffic tape** was used for the transverse lines, and white **EcoStripe field marking spray paint** was used for the pavement markings.

This crossbike was a part of multiple other interventions at this same site, including a parking-protected two-way bikeway that provided safe access to a bike and pedestrian trail around Lake Bella Vista. This bikeway still remains today!

INTERIM DESIGN



Diverter / Offset Intersection Crossing Burlington, VT

The cities street network is often irregular with several offset intersections complicating east-west travel. Thus jogs in the bikeway network often require very site specific, context-appropriate designs to facilitate safe movement for everyone. Crossbike markings, traffic diverters, and wayfinding signs are used to mark clear paths through intersections and to offer physical protection for vulnerable users, including people walking, cycling, or rolling (scooter, skateboard, wheelchair etc.)

The materials used include white and tan **traffic paint** to delineate the curb extension/pinch point, **Sybertech self-watering planters** for beauty and enhanced protection, and **K-71 plastic bollards** for vertical barriers and reflectivity.

